AD-A106 480 DOUGLAS AIRCRAFT CO LONG BEACH CA F/G 18/3

NUCLEAR BLAST RESPONSE COMPUTER PROGRAM. VOLUME I. PROGRAM DESC--ETC(U)

AUG 81 J A MCGREW, J P GIESING, T P KALMAN DNA001-75-C-0216

UNCLASSIFIED AFWL-TR-81-32-VOL-1 NL

1 OF 5

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AFWL-TR-81-32, Vol. I

AFWL-TR-
81-32
Vol. I

NUCLEAR BLAST RESPONSE COMPUTER PROGRAM

Volume I of III
Program Description

J. A. McGrew, et al.

Douglas Aircraft Company
3855 Lakewood Blvd.
Long Beach, CA 90846

August 1981

Final Report

Approved for public release; distribution unlimited.

THIS RESEARCH WAS SPONSORED BY THE DEFENSE NUCLEAR AGENCY UNDER SUBTASK N99AXAE500, WORK UNIT 04, WORK UNIT TITLE: NUCLEAR BLAST RESPONSE COMPUTER PROGRAM.

AIR FORCE WEAPONS LABORATORY
Air Force Systems Command
Kirtland Air Force Base, NM 87117

AFWL-TR-81-32

This final report was prepared by the Douglas Aircraft Company, Long Beach, California under Contracts DNA 001-75-C-0216 and DNA 001-76-C-0346, Job Order 88090340 with the Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico. Mr. Alfred L. Sharp (NTYV) was the Laboratory Project Officer-in-Charge.

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Alfred L. Sharp

ALFRED L. SHARP
Project Officer

FOR THE COMMANDER

Kennedy B. Wilson

KENNEDY B. WILSON
Lt Colonel, USAF
Chief, Environment & Effects Branch

Norman K. Blocker

NORMAN K. BLOCKER
Colonel, USAF
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFWL-TR-81-32, Vol. I of III	2. GOVT ACCESSION NO. AD-A106 480	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) NUCLEAR BLAST RESPONSE COMPUTER PROGRAM Volume I. Program Description		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) J. A. McGrew, J. P. Giesing, T. P. Kalman, H. H. Croxen, W. P. Rodden		8. CONTRACT OR GRANT NUMBER(s) DNA 001-75-C-0216, DNA 001-76-C-0346
9. PERFORMING ORGANIZATION NAME AND ADDRESS Douglas Aircraft Company 3855 Lakewood Blvd. Long Beach, CA 90846		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62601F/88090340
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Weapons Laboratory (NTYV) Kirtland Air Force Base, NM 87117		12. REPORT DATE August 1981
		13. NUMBER OF PAGES 394
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Director Defense Nuclear Agency Washington, D.C. 20305		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

This research was sponsored by the Defense Nuclear Agency under Subtask N99AXAE500, Work Unit 04, Work Unit Title: Nuclear Blast Response Computer Program.

(over)

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Aircraft Structural Response
Mass Modeling
Aerodynamic Modeling
Digital Computer Program
Gust Response
Blast
Nuclear Vulnerability
Dynamic Loads

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The VIBRA-6 computer program is a digital computer program developed to determine the response of aircraft to nuclear explosions when flying at subsonic speeds. It is similar to the VIBRA-4 program but uses the latest Doublet-Lattice Method for obtaining subsonic aerodynamic forces for arbitrary lifting surface-body configurations. The Doublet-Lattice procedure has been extended to account for the moving blast wave by considering it as a traveling gust. The nuclear blast representation remains the same as that used in the
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18. SUPPLEMENTARY NOTES (Continued)

This report is divided into three volumes: Volume I contains the overall program descriptions and method of analysis, the input and output data descriptions, the program operation and a sample problem. Volume II details the unsteady aerodynamic procedure and Volume III contains the program listings.

20. ABSTRACT (Continued)

VIBRA-4 program but the method of solution of the equations of motion has been changed from that of numerical integration of quasi-steady equations of motion to a Fourier transform procedure to move from frequency domain solutions to time history solutions. The concept of dynamic core has been introduced to the program thus removing any restrictions on the size of the aircraft idealization which can be analyzed.

PREFACE

This report was prepared by the Douglas Aircraft Company, Long Beach, California, under Contract DNA 001-75-C-0216 and documents the overall program descriptions and method of analysis, the input and output data descriptions, the program operation and a sample problem. This work was performed under Program Element NWE D 62704H, Project N99QAXA, Task Area E500, Work Unit 04 and was funded by the Defense Nuclear Agency under: RDT & E RMSS Code B342075464N99QAXAE50004H2590D. Funding of this effort was also supported by the Air Force Weapons Laboratory under: Program Element 62601F, Project 8809, Task 03, Work Unit 40. Inclusive dates of research and development were May 1975 through June 1976.

This work was also performed under Program Element NWE D 62704H, Project N99QAXA, Task Area E502, Work Unit 01 and was funded by the Defense Nuclear Agency under: RDT&E RMSS Code B34207T462N99QAXAE50201H2590D. Inclusive dates of research and development were August 1976 through August 1977.

Volume II of this report details the unsteady aerodynamic procedure and Volume III contains the Fortran listing of the program.

J. A. McGrew was the program technical director for this task. The technical development was performed by J. P. Giesing and T.P. Kalman with the assistance of Dr. W. P. Rodden. The programming effort was carried out by T. P. Kalman and H. H. Croxen.

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SECTION I

INTRODUCTION

The VIBRA-6 computer program is similar to earlier versions of VIBRA (Vehicle Inelastic Bending Response Analysis) which were programs designed to calculate the structural response of aircraft exposed to a nuclear blast. Specifically, the present program is an extension of VIBRA-4 (Ref. 1) for response analysis of arbitrary wing-body configurations at subsonic speeds. Aerodynamic interference is accounted for among nonplanar lifting surfaces; e.g., wing, stabilizer, canard and fin, and among slender lifting bodies; e.g., fuselage, nacelle, and external stores. At present, VIBRA-6 has no capability for response analysis at supersonic speeds, and VIBRA-4 continues to provide for that requirement.

The primary extension is in the area of subsonic aerodynamic loads with the moving blast wave considered as a travelling gust. The aerodynamic loads for wing-body interference are based on the extensions of the Doublet-Lattice Method for nonplanar lifting surfaces to include slender body theory and the Method of Images to account for interference (Refs. 2 and 3).

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1. Hobbs, N.P., Zartarian, G., and Walsh, J.P., *A Digital Computer Program for Calculating the Blast Response of Aircraft to Nuclear Explosions*, Air Force Weapons Laboratory, Report No. AFWL-TR-70-140, Vol. I, April 1971.

2. Giesing, J.P., Kalman, T.P., and Rodden, W.P., *Subsonic Unsteady Aerodynamics for General Configurations; Part II-Application of the Doublet-Lattice Method and the Method of Images to Lifting-Surface/Body Interference*, Air Force Flight Dynamics Laboratory, Report No. AFFDL-TR-71-5, Part II, April 1972.

3. Giesing, J.P., Kalman, T.P., and Rodden, W.P., "*Subsonic Steady and Oscillatory Aerodynamics for Multiple Interfering Wings and Bodies*," J. Aircraft, Vol. 9, No. 10, pp. 693-702, 1972.

Volume I of this report contains the overall technical and program description. Volume II of this report documents the modifications to Reference 2 to add the travelling gust field, improvements in the aerodynamic influence coefficients, and changes in the aerodynamic load output. Volume II also contains discussions of the aerodynamic modelling of an entire aircraft with a simple example configuration as well as the details of the aerodynamic program subroutines.

The solution method for the transient response has been changed from the method in VIBRA-4 of numerically integrating the equations to an inverse Fourier transform method. The early versions of VIBRA considered structural inelasticity and large disturbances, but VIBRA-4 restricted the structure to elastic deformations while still considering large disturbances in the rigid body response motion. Experience with VIBRA-4 has indicated that particularly for large bomber or tanker aircraft, if primary structural failure occurs, it generally occurs before substantial changes in the Eulerian angles. The further restriction to small disturbances permits VIBRA-6 to utilize linear response analysis techniques that are also consistent with the assumptions of the linearized aerodynamic analysis. The theoretical aerodynamic loads are not known for arbitrary transient motions but are only known for harmonic motions; i.e., in the frequency domain. The appropriate linear response analysis method is therefore a Fourier transform method, and Zartarian (Ref. 4) has demonstrated the feasibility of calculating transient blast loads by the Doublet-Lattice Method and Fourier trans-

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4. Zartarian, G., *Application of the Doublet-Lattice Method for Determination of Blast Loads on Lifting Surfaces at Subsonic Speeds*, Air Force Weapons Laboratory, Report No. AFWL-TR-72-207, January 1973.

forms. The frequency response of the vehicle in a harmonic travelling gust field becomes the fundamental part of the solution. From the time history and orientation of the blast overpressure and its following travelling gust, the Fourier transform of the gust field may be calculated. The product of the vehicle frequency response and the transform of the gust field is the Fourier transform of the transient response of the vehicle to the blast. Its inverse transform is the desired transient response.

The assumed linearity of the system permits superposition of the blast response loads with the loads in trimmed flight. The trimmed maneuvering conditions considered are level flight or a symmetrical pull-up or pushover with the velocity vector horizontal at the time of blast wave intercept (as in VIBRA-4), and a level, climbing, or descending steady turn (VIBRA-4 considered the steady turn at constant altitude). A new trim solution is provided that is based on the aerodynamic influence coefficients from the wing-body theory. Angle of attack and elevator setting are determined for a given speed, load factor, elevator, rudder, and aileron settings are determined for a given speed, load factor, rate of climb, and altitude in the steady turning meneuvers. The final equilibrium loads on the aircraft are then the sum of the elastic aircraft trimmed flight loads and the incremental loads due to the dynamic perturbation response.

The interaction between the response caused by the blast loading and the autopilot can be a critical problem and has not been considered in previous versions of VIBRA. This interaction can cause significant stresses as the autopilot attempts to restore the disturbed vehicle to its initial trimmed flight condition. The autopilot is included in the system by adding the transfer functions of the autopilot components. These equations relate the signals sensed from the vehicle motion; e.g.,

by rate gyros or accelerometers, to the motions of control surfaces commanded by the active control system. The additional equations are written as transfer functions which are expressed as ratios of polynomials in the Laplace transform variable and become ratios of polynomials in the frequency domain which then may be used to augment the aeroelastic equations of motion.

The internal structural loads (called integrated loads) are found by integrating the resultants between the applied aerodynamic loads (from the gust and the induced motion) and the inertial reactions (called equilibrium loads). The structural loads are shears and moments (bending moments and torques) and are obtained by numerical integration of the pressure loads at the aerodynamic panel and body points and the inertial loads at the structural mass points. Internal loads can be calculated for any or all of the components of the vehicle; i.e., the wing, stabilizer, fin, fuselage, nacelles, pylons, etc., and at as many stations as desired. The internal loads may also be converted into stresses by providing a stress transformation matrix containing the necessary section property data at each load station.

An option has also been included for experimental correlation studies. The measured blast characteristics can be input and the time histories of pressures at the transducer locations can be calculated and compared with the measurements. The assumption is made that the model is rigid.

The concept of dynamic core has been utilized throughout, thus restricting the limitations of problem size only to that of computer capacity.

Volume III of this report contains the program code listings.

SECTION II

GENERAL THEORY

The VIBRA-6 computer program is a modularized extension of the VIBRA-4 program. It consists of twelve principal modules. Output data from four major modules, as explained below, may be saved on tape, at the option of the user, so that subsequent runs will not require recalculation of the same data. The twelve module interactions and the saved data are shown in Figure 1. Additional modules for further extensions of capability may be inserted with relative ease in computer programs organized in this fashion, since each module is a stand-alone subprogram with the interfacing provided by the control module.

The VIBRA-6 program has been coded using the principles for a dynamic core allocation. The program has been coded so that the computer core required for execution of any specific solution consists only of that necessary for the program (using an efficient overlay) and the core required for the data associated with the largest module to be executed in the case. This results in a cost savings since the user is charged only for the core actually used.

Although Figure 1 serves to illustrate the efficiency of the modular program under the direction of the control module, a flow chart is necessary to show the logical flow of the computational sequence. The flow chart is shown in Figure 2. The flow chart shows the necessary steps in the transient response analysis by modal and Fourier transform methods. The steps in order include calculation of:

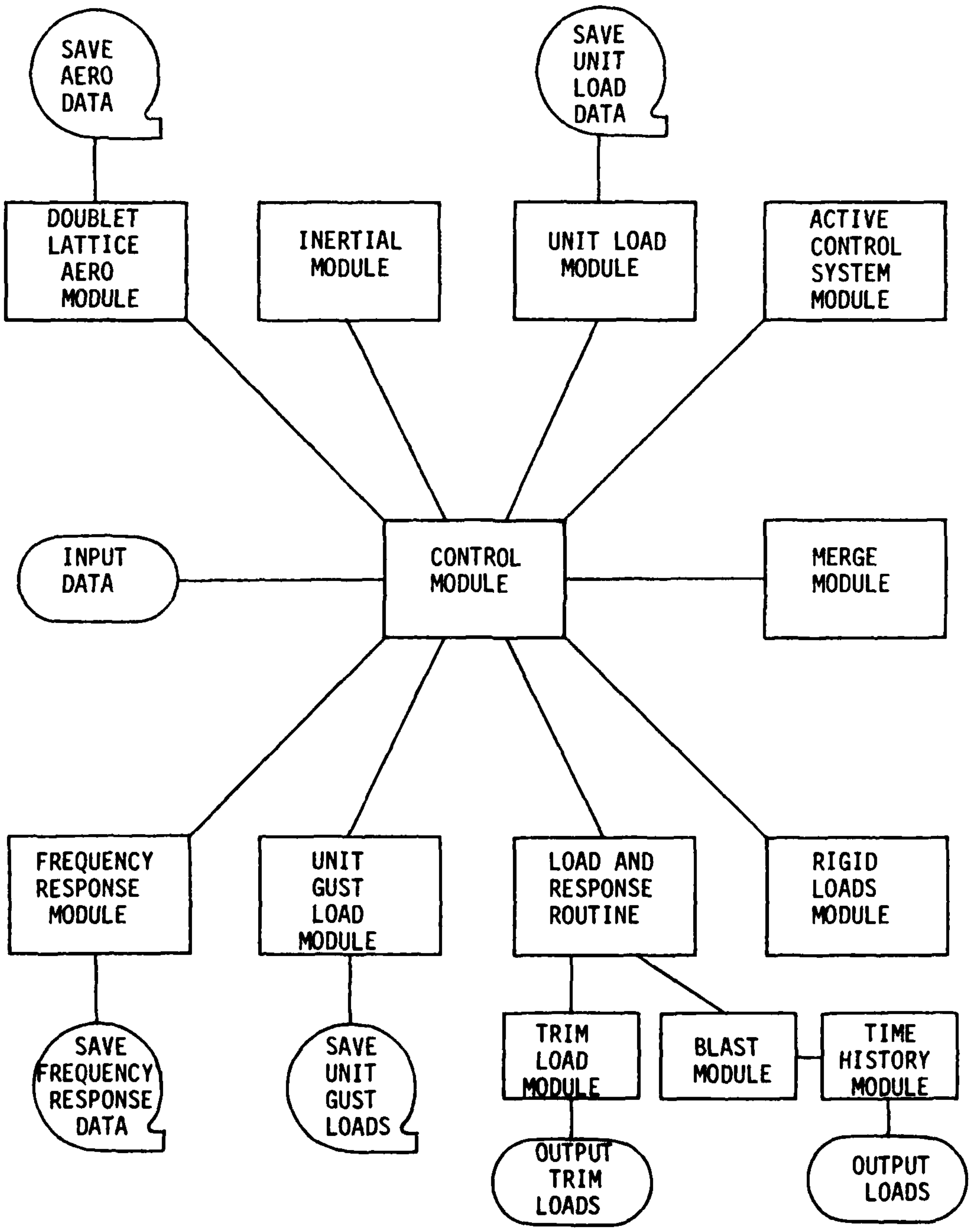

Figure 1. VIBRA-6 Modular Organization

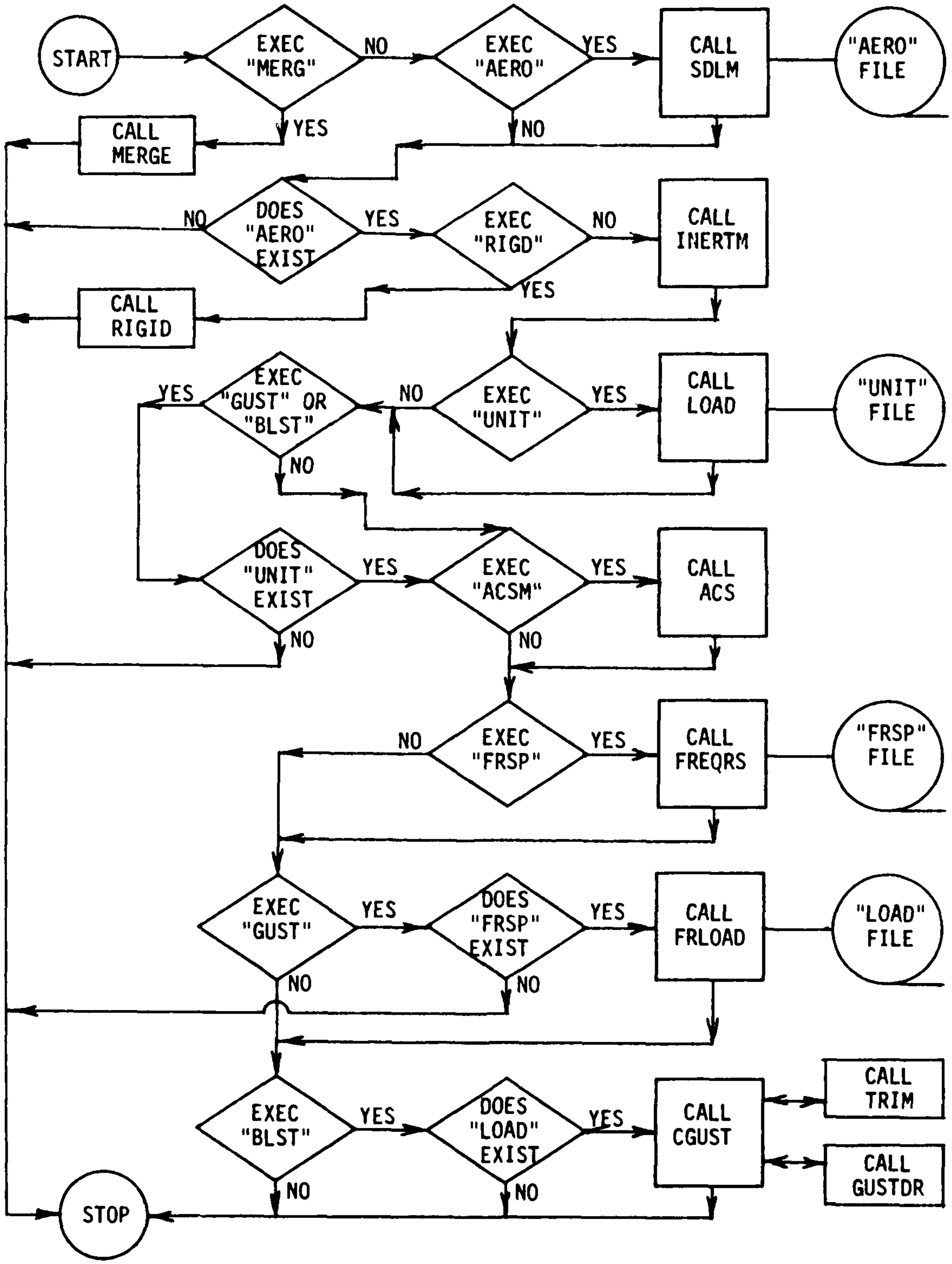

Figure 2. Program Analysis Flow Chart

1. The generalized aerodynamic forces for motion and the harmonic travelling gust field and the physical aerodynamic forces for load calculations.
2. Generalized mass, stiffness and damping forces for the structure.
3. The integrated loads (i.e., the internal shears, bending moments and torques) caused by unit aerodynamic and inertial control point loads.
4. The transfer functions and modal data necessary to obtain additional terms in the modal equations of motion arising from the active control systems.
5. The frequency response of the vehicle modes to the unit harmonic travelling gusts of varying orientations.
6. The symmetrical and antisymmetrical integrated loads for the unit gust.
7. The trim load distribution for level flight, a symmetrical pull-up, or a climbing (or descending or level) steady turn.
8. The time history of the blast induced gust field velocities.
9. The Fourier transform of the blast time history, the inverse Fourier transform of the frequency response of the vehicle to the blast to obtain the transient time history of the response, and, finally, the iteration for the critical range.

The general theory for each of the computational steps is outlined below. The detailed equations are given later with the descriptions of the various modules.

The subsonic aerodynamic forces are calculated by the Doublet-Lattice Method and the Method of Images (Refs. 2 and 3). The aerodynamic influence coefficients are determined for harmonic motion, and the load distribution is found for the harmonic travelling gust field. Then using the aerodynamic mode shapes which are read in for each rigid body and vibration mode, or determined from inertial modes, internally, if the h-α modal input is used, and specified at the aerodynamic control points, the generalized aerodynamic forces are obtained for motion and for the gust field. The generalized forces correspond to unit generalized coordinates and a unit gust amplitude. These aerodynamic matrices are formed for a limited number of reduced frequencies and are dependent on the Mach number but are independent of the flight velocity. These data are saved on tape.

The generalized mass and stiffness matrices are calculated from the mass, frequency and inertial mode shape data. The mass matrix and the vibration frequencies are read in along with the rigid body and vibration mode shapes as specified at the mass points. The generalized mass matrix is found from the mass matrix and the modes; and the generalized stiffness is determined by the generalized mass and the vibration frequencies.

The integrated loads consist of the internal shears, bending moments, and torques at stations and in directions specified by the user. From the geometry of the structural model and the location of the mass points and aerodynamic panel and body points, the structural reactions are determined for unit values of the inertial and thrust forces and the aerodynamic forces, and unit generalized response. These integrated inertial loads and the integrated aerodynamic loads are saved separately on tape until

the inertial and aerodynamic load distributions are found in the response analysis from which the combined integrated inertial and aerodynamic loads are calculated for use in the stress analysis. Loads due to engine thrust are included also.

The active control system transfer functions are found and the kinematic relationships between sensed and commanded motion established with input data defining the sensed and driven degrees of freedom. These data are saved in core for subsequent use in the frequency response and unit gust load analyses.

At this point, all data have been independent of flight condition, with the exception of Mach Number.

The modal frequency response of the aircraft is found from the generalized mass, aerodynamic, and stiffness matrices and the active control system for unit gusts of all available orientations at a specified flight altitude and velocity. Symmetric and antisymmetric solutions are formed. These solutions are obtained at arbitrary user specified frequencies, with spline interpolation employed to obtain the aerodynamic forces at frequencies other than those used for the basic aerodynamic matrix calculations. These data are saved on tape.

The symmetric and antisymmetric integrated loads due to the unit gust are found from the modal frequency response and the unit load solutions for all orientations and saved on tape.

The availability of aerodynamic influence coefficients permits the

estimation of all the stability derivatives, including static aeroelastic behavior, that are necessary to solve for the trim condition. For the symmetrical case, the angle of attack and a symmetric trim mode permit calculation of the longitudinal stability derivatives and, with the velocity, ambient density, and load factor specified, the trim angle of attack and horizontal stabilizer (or elevator) deflection are calculated. The load distribution on the vehicle then follows. For the case of a steady turn, additional lateral-directional derivatives are required. These require the aileron, rudder (or its equivalent), and yaw rate modes. With the addition of these lateral-directional derivatives to the longitudinal set, the angle of attack, stabilizer, aileron and rudder deflections are determined for a given speed, ambient density, load factor and rate of climb. The load distribution on the aircraft again follows.

The blast induced gust time history is obtained for specified range and yield in the same fashion as in the VIBRA-4 program.

The Fourier transform of the blast time history is found numerically from the integral definition of the transform and the assumed or specified profile of the transverse blast velocity. The numerical evaluation of the integral is straightforward.

The product of the Fourier transform of the blast profile and the frequency response of the vehicle modes to the unit harmonic travelling gust is the Fourier transform of the transient response to the specified blast wave. The inverse transform of the product is therefore the desired time history of the modal responses. The numerical evaluation of the inverse transform integral is also straightforward and is similar to that

for the forward transform integral. Superposition of the loads due to maneuvering give the final integrated load time histories and stress time histories.

Numerical checks on the time histories of the integrated loads are made against input allowable loads or stresses and an estimate is made of the allowable peak gust velocity and overpressure. Iteration then is carried out (if desired) to establish the critical range for specified orientations and flight conditions.

Two coordinate systems are used in VIBRA-6. They are the Earth Fixed Axis System (EFAS) and the Aircraft Axis System (AAS). The AAS is used for definition of the aircraft geometry and determination of its modes, mass, and aerodynamics. Figure 3 illustrates the AAS system. The EFAS is used to position the AAS in space and establish the burst to aircraft relations as a function of time. Figure 4 shows the EFAS system. The aircraft is initially positioned at the input altitude at time zero (shock intercept) and out the Y_{EFAS} axis a distance R_T where R_T is the turn radius (if the aircraft is in a turn). Time at time of burst is negative. Unlike VIBRA-4, the EFAS is fixed at sea level and the burst is located in space from the orientation direction cosines in the AAS system and the initial slant range at time of intercept. The assumption has been made that at distances from the burst, corresponding to damage thresholds for large subsonic aircraft, the shock front appears planar to the aircraft and the shock front is moving at sonic velocity.

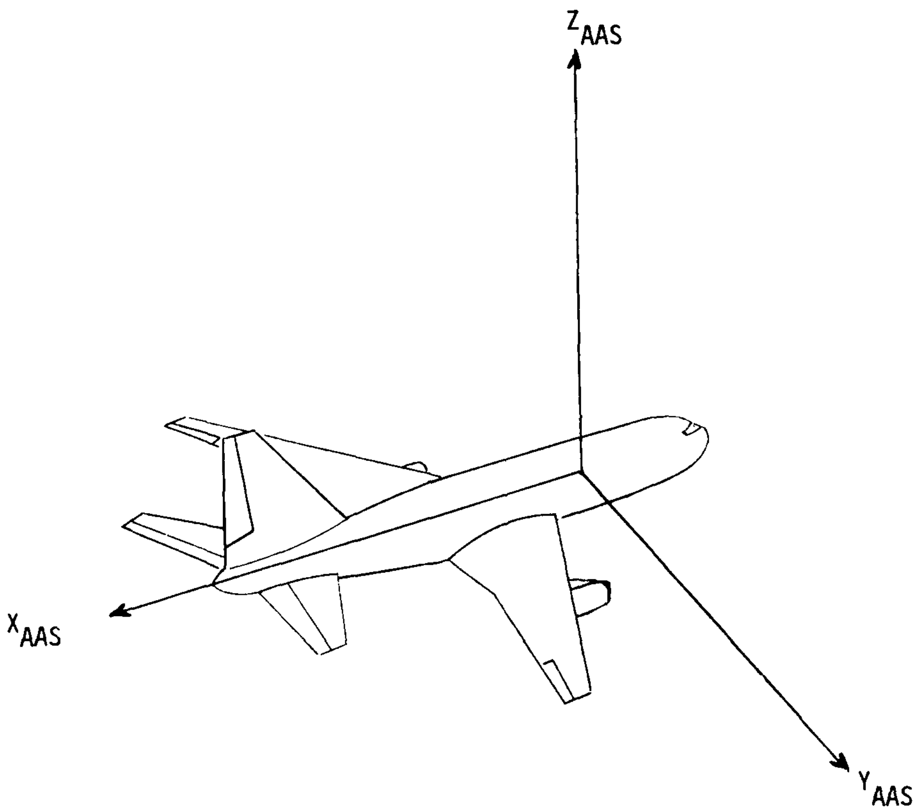

Figure 3. Aircraft Axis System (AAS)

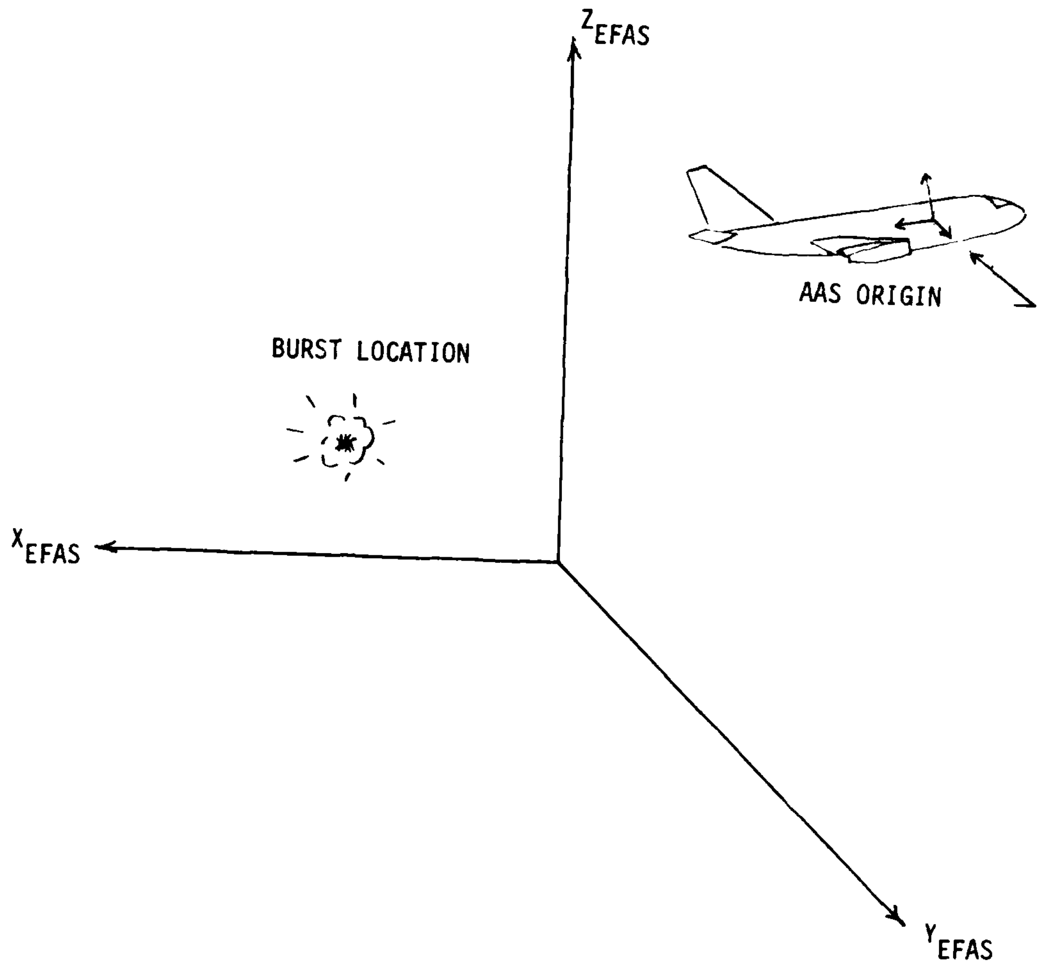

Figure 4. Earth Fixed Axis System (EFAS)

SECTION III

MODULE DESCRIPTIONS

This section describes the operation of the various modules presently in VIBRA-6. Contained within each module description are the equations for the solutions. Nomenclature is defined as used.

In some instances matrix operations are shown in the figurative sense whereas the actual coding for the most part carries out such operations in a more efficient fashion.

1. CONTROL MODULE

This module serves to control program data flow and operation. All data necessary to the modular execution and dimensioning of the modules are read into this module. Data to any module have three sources at a given point of execution: the input data file (card or disk), core stored data, or generated data files (tape or disk). The modularization of the program allows the generation of a data base of files which may be reused for a specific aircraft configuration thus avoiding the necessity of recalculation of the majority of basic data necessary for final solution.

The input data file is divided into two classes: fixed data and run data. Fixed data are data which describe the basic configuration under analysis and are expected to vary the least, while run data varies from case to case. The collection of these data is called the Fixed Data Deck and the Run Data Deck. While the Fixed Data Deck must be available to the program during execution, only the data needed for execution during any single phase is used. Header cards are used within the Fixed Data Deck to define particular groupings of data.

The following input data file data comprise the Fixed Data Deck:

- Data necessary for execution of the aerodynamic module.
- Data necessary for calculation of the generalized mass, stiffness and damping in the inertial module.
- Data necessary for calculating unit loads matrices in the unit loads module.

The following input data file data comprise the Run Data Deck:

- Flight condition data.
- Data necessary to define the active control system.
- Frequency data for the frequency response module.
- Data for defining the maneuver condition.
- Data for definition of the blast condition.

Generated data consist of stored arrays which result from execution of four of the modules. If these data are available to the program and so noted by the user, the program draws upon the files as necessary. Core data consist of data which are minimal in cost to generate and required in numerous parts of the overall program and thus are not saved as generated file data.

Figure 5 details the major routines called by the control module, each of which is the controlling routine of a module. Tables 1 and 2 illustrate the data requirements for each module and the data source. A more complete description of the data input, module by module, is contained in the module descriptions following. In these descriptions, input data file is referred to as 'card' input and generated data file is referred to as 'tape' data.

The analysis of an aircraft can be carried out with a single pass through the program. The suggested procedure for operation is to develop aerodynamics for a few Mach numbers, unit loads once, and cycle through the active system, frequency response, and unit gust load modules for as many airspeed/altitude conditions as required. Then, cycle through the trim, blast and time history modules only for maneuver and blast conditions as required.

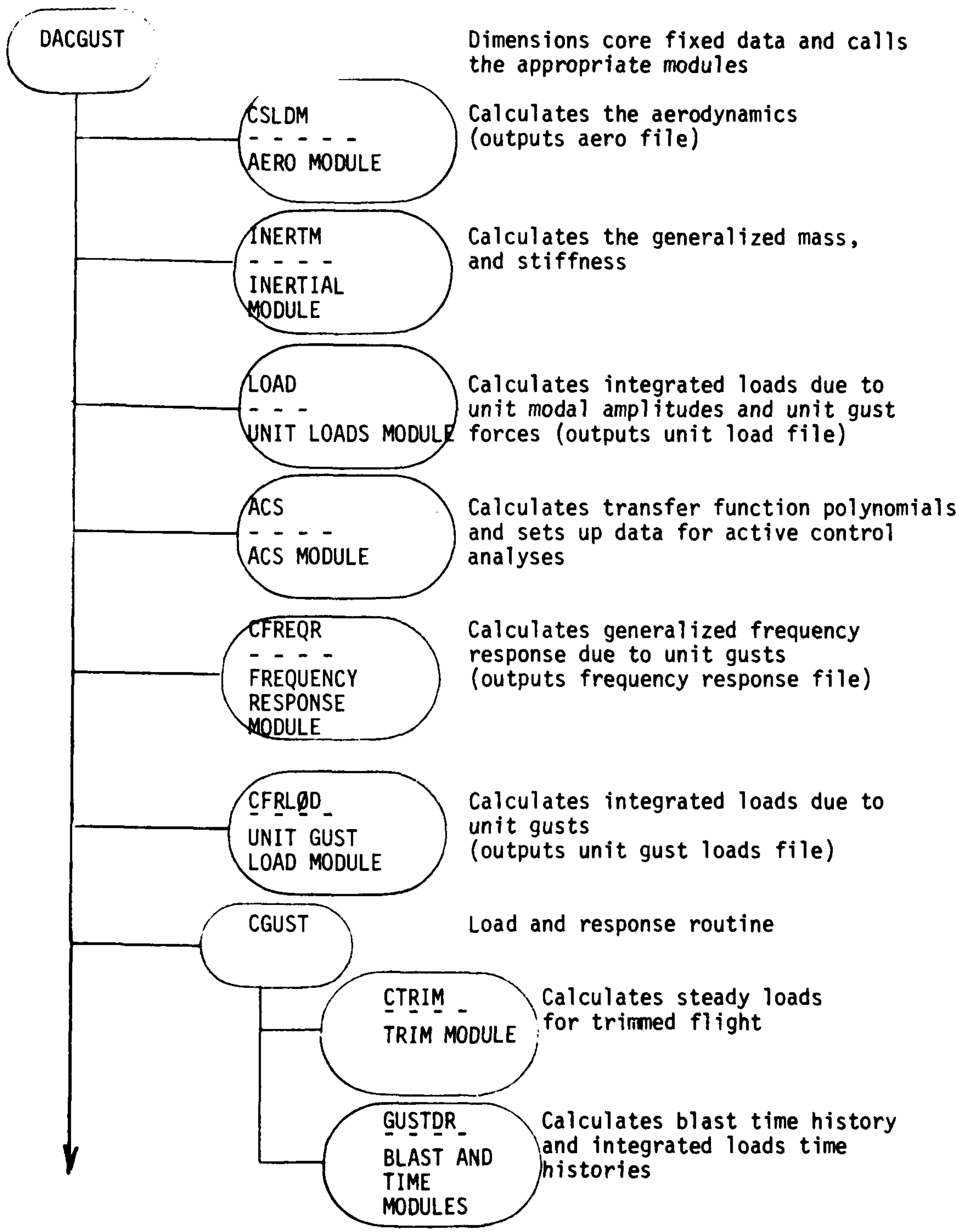

Figure 5. Control Module Routines

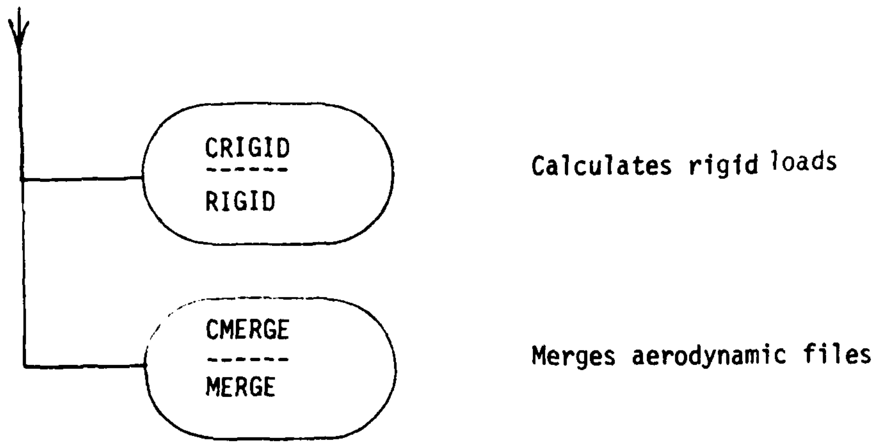

Figure 5 (cont'd). Control Module Routines

TABLE 1

MODULE EXECUTION REQUIREMENTS
FOR NEW DATA INPUT

	MODULE AFFECTED	R = RERUN REQUIRED FDD = FIXED DATA DECK DATA REQUIRED RDD = RUN DATA DECK DATA REQUIRED					
MODULE EXECUTED FOR NEW DATA	AERO	INERTIAL	ACTIVE CONTROL	UNIT LOAD	FREQUENCY RESPONSE	UNIT GUST LOAD	BLAST RESPONSE
AERODYNAMIC	FDD	R	R	R	R	R	R
INERTIAL		FDD	R	R	R	R	R
ACTIVE CONTROL			RDD		R	R	R
UNIT LOAD				FDD		R	R
FREQUENCY RESPONSE					RDD	R	R
UNIT GUST LOAD						RDD	R
BLAST RESPONSE							RDD

Note: Inertial module is always exercised with input of run data.

TABLE 2

BASIC DATA REQUIREMENT AND TRANSFER

	INPUT (FDD = FIXED DATA DECK, RDD = RUN DATA DECK)			OUTPUT	
MODULE	CARD DATA	CORE DATA	GENERATED DATA FILE	CORE DATA	GENERATED DATA FILE
AERODYNAMIC	(FDD) AERO GEOM. AERO MODES ORIENTATIONS REDUCED FREQ MACH NO.				AERO GEOM. $D\phi_S$, $D\phi_A$ F_S, F_A $\mathcal{D}_S$, $\mathcal{D}_A$ SPLHS, SPLHA
INERTIAL	(FDD) MASS GEOM. MASS FREQUENCIES INERTIA MODES MODE DEF.			m κ g $M\phi_I$ MODE DEF.	
UNIT LOAD	(FDD) BEAM GEOM. INT'GD LOAD GEOM. LOAD ALLOW. STRESS DEF. MASS SPARSING MASS ORIENT. BOX SPARSING BODY SPARSING ENG. GEOM.	MASS GEOM. ϕ_I $M\phi_I$	AERO GEOM. $D\phi_S$, $D\phi_A$		PIQ PAQS PAQA THRGNF THRLØD PINT STRESS
ACTIVE SYSTEM	(RDD) ACS KINEMATICS BLOCK DATA	ϕ_I		ACS KINEMATICS T_S, T_A	
FREQUENCY RESPONSE	(RDD) FREQUENCIES ALTITUDE AIRSPEED	m κ g T_S, T_A ACS KINEMATICS MODE DEF.	$\mathcal{D}_S$, $\mathcal{D}_A$ F_S, F_A SPLHS, SPLHA		q
UNIT GUST LOADS		T_S, T_A ACS KINEMATICS	q PIQ PAQS PAQA F_S, F_A PINT STRESS		P_S, P_A STRESS

TABLE 2 (cont)

BASIC DATA REQUIREMENT AND TRANSFER

MODULE	CARD DATA	CORE DATA	GENERATED DATA FILE	CORE DATA	GENERATED DATA FILE
TRIM	(RDD) MANEUVER DATA THRUST	MODE DEF. m α	$\mathcal{D}_S$, $\mathcal{D}_A$ PIQ PAQS PAQA THRGNF THRLØD	P_{STRIM} P_{ATRIM}	
BLAST AND TIME RESPONSE	(RDD) ORIENTATIONS YIELD & RANGE MAX TIME ALLOWABLES	P_{STRIM} P_{ATRIM}	P_S, P_A STRESS	$\bar{P}$ σ	

2. AERODYNAMIC MODULE

The aerodynamic module SDLM has been modified from the computer program of Reference 2. The modifications to add a travelling gust field, improve the aerodynamic influence coefficients, and change the load output, are discussed in detail in Volume II of this report. The basic data requirements and output are summarized here for convenience. This module serves to provide the aerodynamic forces due to motion and the travelling gust and the generalized aerodynamic equations for solution of the blast response problem

The geometry required is that necessary to describe the lifting surfaces, the slender bodies, and the interference surfaces between the lifting surfaces and bodies. The lifting surfaces are idealized as plane panels with no thickness, camber, or twist, but with dihedral. Each lifting surface is subdivided into smaller trapezoidal lifting elements (boxes) arranged in strips parallel to the freestream such that box boundaries lie on surface edges, fold lines, and control surface edges. For coplanar or near-coplanar surfaces, e. g., a wing and tail, the boxes must be aligned in the streamwise direction. For non-coplanar surfaces alignment is not required if the perpendicular separation is more than one strip width. For intersecting surfaces the box edges must also be located at intersections, as in the case of a wing pylon.

The idealization of fuselages, nacelles, or external stores as slender bodies does not require geometric similarity to the actual body, but it is recommended that the best elliptical representation of the body cross-sectional area be used. The displacements of the body during motion are accounted for in the upwash and sidewash boundary conditions. All bodies, including jet engines, must be idealized as having pointed noses; however, a body need not

be closed at its downstream end and a suitable base area may be selected to approximate flow separation effects. In addition to the idealization of the body cross sections, the body length is divided into segments. Each segment is described by its length and width at each end. Smaller lengths are chosen where the body cross section is changing rapidly and in regions of maximum interference with lifting surfaces such as occur near the wing root or at a nacelle-pylon intersection.

The interference surface is a cylindrical tube with an elliptical cross section. All attached lifting surfaces are connected to this tube. Within this tube is placed a system of images of the external lifting elements, and the image system approximately negates the flow field at the body surface induced by lifting surfaces. The interference tube is segmented into elements by means of angular divisions around its circumference and streamwise divisions along its length. Since the interference elements increase the computational cost, their number should be limited, but they need only be used near lifting surface/body intersections and only upstream and downstream within a chord-length of the lifting surface. In situations in which high accuracy is not required, e.g., for small external stores, the interference elements might be eliminated altogether.

In addition to the geometry of the idealized aerodynamic configuration, the aerodynamic load calculation requires the normalwash distribution at the aerodynamic elements. The aerodynamic control points are located differently on the lifting surfaces and on the slender bodies. On the lifting surfaces, the normalwash control point is chosen at the three-quarter chord point of the centerline of each box and the lift acts at the one-quarter chord point. On the slender body elements, both the normalwash and lift (or side force)

are determined at the midpoint of the segment length. The deflections and slopes at these points are determined by a surface spline interpolation among a set of deflections of aerodynamic modes. The aerodymamic modes differ from the structural modes to the extent that they cover the lifting surfaces and slender bodies more completely, e.g., including the leading and trailing edges, whereas the structural modes give the deflections only at the mass points. The increased area covered by the aerodynamic modes improves the accuracy of interpolation for the normalwashes and deflections and, hence, the accuracy of the generalized aerodynamic forces. The aerodynamic modes correspond to the vehicle rigid body and elastic modes, the control surface and trim modes, and jig modes. The jig modes are necessary to establish the basic pitching moment and basic lift distributions over the vehicle, and they describe the positions from the reference aerodynamic planes of the actual chord lines of surfaces, (camber and twist), and local body pitch and surface pitch.

The aerodynamic influence coefficients (AIC's) of Reference 2 are useful either in a direct influence coefficient solution, which avoids modal convergence problems, or in the modal solution which consider many varying modes, e.g., modes that change because of design changes in stiffness or weight distribution. Since the AIC's depend on the planform (and Mach number and reduced frequency) and not on the modes, the generalized aerodynamic forces are easily obtained from the AIC's,

$$[\mathcal{L}] = [\phi_A]^T [AIC] [\phi_A]$$

where $[\phi_A]$ is the matrix of modal deflections at the aerodynamic nodal points. The additional calculations required to obtain the AIC's are not justified for the VIBRA-6 analysis because only a few sets of modes are considered in a response analysis. The modifications to Reference 2 described in Volume II

of this report are summarized below along with a few basic relationships necessary for use of the finite element aerodynamics.

Let [SPL] be the spline interpolation matrix that yields the complex normalwash $\{\bar{w}\}$ from the deflections $\{h_A\}$ at the aerodynamic nodal points

$$\{\bar{w}\} = [SPL]\ \{h_A\}$$

The nodal point deflections $\{h_A\}$ may be regarded as either translations or rotations. The modal solution expresses the deflections as a series of vibration modes with generalized coordinates $\{q\}$:

$$\{h_A\} = [\phi_A]\ \{q\}$$

and the modal approximation to the normalwash is

$$\{\bar{w}_q\} = [SPL]\ [\phi_A]\ \{q\}$$

The Doublet-Lattice Method initially relates the downwash to the local pressure coefficients by the relationship (Ref. 5 and 6) through:

$$\{\bar{w}_q\} = [D_{DLM}]\ \{\Delta C_p\}$$

where $[D_{DLM}]$ is a large matrix. The downwashes, however, are given in terms of a reduced set of coordinates q as shown above. The forces on the boxes and slender bodies are given in terms of the pressure coefficients by:

$$\{F_B\} = [F_{DTP}]\ \{\Delta C_p\}$$

where $[F_{DTP}]$ is an integration matrix relating local force to local pressure. These forces then are obtained by the general relationship:

$$\{F_B\} = [F_{DTP}]\ [D_{DLM}]^{-1}\ [SPL]\ [\phi_A]\ \{q\}$$

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5. Albano, E., Rodden, W.P., A *Doublet Lattice Method for Calculating Lift Distributions on Oscillating Surfaces in Subsonic Flows*, AIAA Journal Vol. 7, No. 2, February 1969.

6. Kalman, T.P., Rodden, W.P., Giesing, J.P., *Aerodynamic Influence Coefficients by the Doublet Lattice Method for Interfering Nonplanar Lifting Surfaces Oscillating in a Subsonic Flow*, IRAD Final Report, DAC-67977, November 1969.

where the inverse is not actually carried out, but the forces due to unit q obtained by solving for the number of right-hand sides corresponding to the number of modes required. The generalized forces are given in terms of the above forces by the relationship:

$$\{\mathcal{F}\} = [\phi_A]^T [SPLH] \{F_B\}$$

where [SPLH] is an interpolation matrix relating local force to aerodynamic nodal point forces. The stored generalized aerodynamic forces due to motion then are given symbolically by

$$[\mathcal{D}] = [\phi_A]^T [SPLH] [F_{DTP}] [D_{DLM}]^{-1} [SPL] [\phi_A]$$

and the stored local aerodynamic forces due to motion (necessary for integrated loads) by:

$$[D\phi] = [F_{DTP}] [D_{DLM}]^{-1} [SPL] [\phi_A]$$

The gust loads are calculated for each orientation of the aircraft and the blast. The unit normalwash $\bar{w}_g$ *induced by the blast at a point* on the aircraft is given (in Vol.II) by

$$\bar{w}_g (x, y, z) = G_o \Omega \exp (- i 2 k_r \ell R/\bar{c})$$

where

G_o = the amplitude of the harmonic blast material velocity

$\Omega = \vec{n} \cdot \vec{v}_g$

$\vec{n}$ = the unit normal vector to the lifting surface or slender body

$\vec{v}_g = i \cos\alpha + j \cos\beta + k \cos\gamma$

α, β, γ, = the blast orientation angles

$k_r = \omega\bar{c}/2U$

ω = circular frequency

$\bar{c}$ = reference chord

U = aircraft velocity

$\ell = x \cos\alpha + y \cos\beta + z \cos\gamma$

$$R = U/(V_g + U \cos\alpha)$$

V_g = velocity of blast pressure wave

In general, an arbitrary burst location results in an asymmetric loading of the flight vehicle. Since any asymmetric condition can be found as a linear combination of a symmetric and an antisymmetric condition (assuming linear systems), both symmetric and antisymmetric aerodynamic gust analyses must be performed. If the gust normalwash on the right side is $\bar{w}_g(x, y, z, \bar{\gamma})$ and on the left side is $\bar{w}_g(x, -y, z, -\bar{\gamma})$, then the symmetrical normalwash is

$$\bar{w}_{gs} = (1/2)\,[\bar{w}_g(x, y, z, \bar{\gamma}) + \bar{w}_g(x, -y, z, -\bar{\gamma})]$$

and the antisymmetrical normalwash is

$$\bar{w}_{ga} = (1/2)\,[\bar{w}_g(x, y, z, \bar{\gamma}) - \bar{w}_g(x, -y, z, -\bar{\gamma})]$$

The symmetric and antisymmetric normalwashes can be used as outlined above to obtain sets of symmetrical and antisymmetrical local forces $\{F_g\}$ and generalized forces $\{\mathcal{F}_g\}$.

$$\{F_g\} = [F_{DTP}]\,[D_{DLM}]^{-1}\,\{\bar{w}_g\}$$

$$\{\mathcal{F}_g\} = [\phi_A]^T\,[SPLH]\,\{F_g\}$$

The aerodynamic data required for the blast response analysis consist therefore of generalized aerodynamic forces for symmetric and antisymmetric modes of vibration, and for symmetric and antisymmetric harmonic gust fields having a number of orientations. The orientations depend on the burst locations. A standard set of thirteen burst locations is shown in Figure 6. Other orientations may be chosen but must be specified separately by the user. The generalized forces are required at a sufficient number of reduced frequencies that interpolation will lead to accurate values at intermediate frequencies.

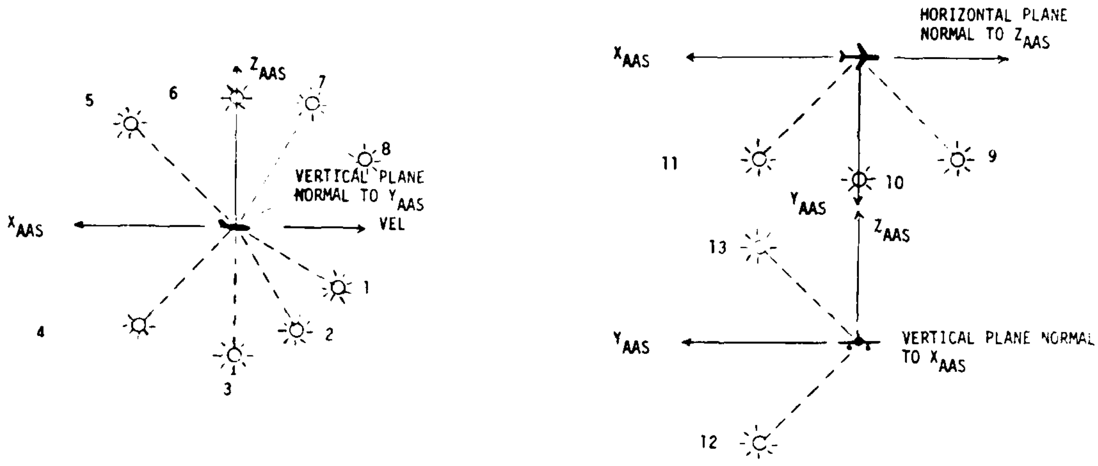


Figure 6. Blast Orientations for Aero Module

The spacing of the reduced frequencies necessary for an accurate interpolation depends on the blast orientation; an estimate is given as:

$$\Delta k_r = \pi P/\mu_1 ; \; P = (1 + M_\infty \cos\alpha)/M_\infty \bar{\ell}/\bar{c}$$

where $\bar{\ell}$ is the slant distance from a point on the aircraft to the blast plane, as the blast plane passes through the aircraft origin. If the maximum distance $\bar{\ell}$ is used the estimate for Δk_r will be conservative for all points on the aircraft.

The maximum reduced frequency, $k_{r_{max}}$, that is necessary to consider is estimated as:

$$k_{r_{max}} = \mu_2 P$$

where μ_2 is approximately 2.5. In many cases the $k_{r_{max}}$ value is above the practical limit for the Doublet Lattice Method (which is 2 or 3). For such cases piston theory is used to fill the gap between the DLM $k_{r_{max}}$ and the one required by the above formula. The application of piston theory is discussed in Vol. II, Section II-4, and is based on the following relation:

$$\Delta C_p = (4/M_\infty) \bar{W}/V$$

where $\bar{W}/V$ is the dimensionless downwash.

3. INERTIAL MODULE

The inertial module calculates the generalized mass and stiffness from the specified inertial mode shapes and point mass data. Input data which are used for core allocation consist of the number of masses for the half aircraft analysis and the number of symmetric and antisymmetric modes used (which must agree with the aerodynamic module input.) Array data input consists of:

- The point mass data for the right side of the aircraft and the point coordinates in the AAS system. Though the analyses are carried out for only half an aircraft, full centerline mass point data are loaded.

- Inertial mode shapes and associated frequencies defining the motion in three orthogonal axes at each point (identified as PHIX, PHIY, and PHIZ.)

- An array called AMØDNØ which defines the type of modes by location in the modal array. The input requirement is set that all symmetric modes precede all antisymmetric modes and the order of inertial mode input within these general groupings must agree with the aerodynamic mode ordering sequence. The rigid body modes must have zero frequency input and input modes defining any jig modes must be present, but may be of zero deflection.

- The structural damping of each mode, which should be zero for all but the elastic modes.

The inertial mode shapes (as distinguished from the aerodynamic mode shapes) define the mass point motion in each mode. The motion of each point must consist of three orthogonal modal deflections but they need not necessarily

be deflections parallel to the AAS system. (Input data in the unit loads module are provided to establish the alignment of these deflections in terms of AAS system motion.) The modes need not be aircraft free-free modes, as the analysis procedure will, in effect, orthogonalize the modes in the event that constrained modes are used. A distinction is made, however, between modes used to describe the symmetric and antisymmetric motion of the aircraft.

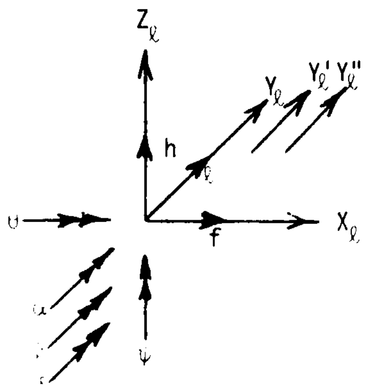
There are two formats for the mass data. The first simply consists of the concentrated masses at each mass point. The second consists of the sectional mass data for each section when the modes are specified by the user in terms of sectional translations and slopes (called the h and α input). The first format is a subset of the second although the two have been programmed separately. The sectional mass matrix is shown in Figure 7 for the maximum number of eight degrees of freedom. Figure 8 shows the local coordinate systems of the mass data and modeshapes for typical components. The mass matrix itself is not input to the program. The mass properties are input and the program forms the mass matrix internally from the mass properties.

The generalized mass matrix is given by

$$[m] = [\phi_I]^T [M] [\phi_I]$$

where $[\phi_I]$ is the array of all inertial shapes. The off-diagonal terms of the generalized mass matrix coupling symmetric and antisymmetric modes are zeroed since the assumption of a vertical plane of symmetry in mass, stiffness and geometry is made, and thus this coupling is identically zero for free-free modes but not arithmetically for the one half aircraft analyses.

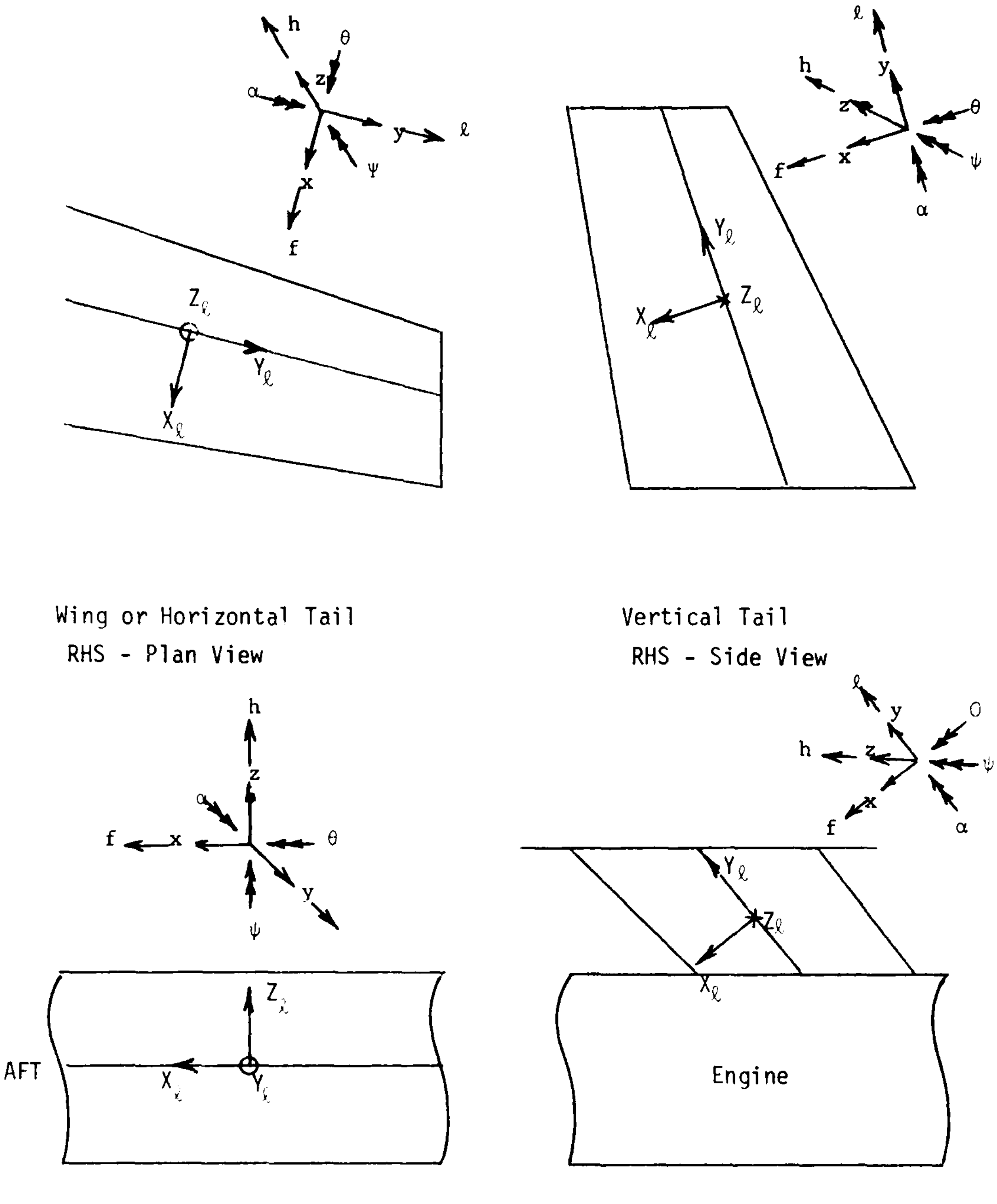
The generalized stiffness is given by



local coordinate system
right-hand side of aircraft

	f	ℓ	h	θ	α	ψ	β	δ
f	M	0	0	0	$M\Delta Z$	$-M\Delta Y$	$+S_{f\beta}$	$+S_{f\delta}$
ℓ	0	M	0	$-M\Delta Z$	0	$M\Delta X$	0	0
h	0	0	M	$M\Delta Y$	$-M\Delta X$	0	$-S_{h\beta}$	$-S_{h\delta}$
θ	0	$-M\Delta Z$	$M\Delta Y$	I_{xx}	$-I_{xy}$	$-I_{zx}$	$-P_{\theta\beta}$	$-P_{\theta\delta}$
α	$M\Delta Z$	0	$-M\Delta X$	$-I_{xy}$	I_{yy}	$-I_{yz}$	$P_{\alpha\beta}$	$P_{\alpha\delta}$
ψ	$-M\Delta Y$	$M\Delta X$	0	$-I_{zx}$	$-I_{yz}$	I_{zz}	$-P_{\psi\beta}$	$-P_{\psi\delta}$
β	$-S_{f\beta}$	0	$-S_{h\beta}$	$-P_{\theta\beta}$	$P_{\alpha\beta}$	$-P_{\psi\beta}$	$I_{\beta\beta}$	$P_{\beta\delta}$
δ	$-S_{f\delta}$	0	$-S_{h\delta}$	$-P_{\theta\delta}$	$P_{\alpha\delta}$	$-P_{\psi\delta}$	$P_{\beta\delta}$	$I_{\delta\delta}$

Figure 7. Sectional Mass Matrix



Wing or Horizontal Tail
RHS - Plan View

Vertical Tail
RHS - Side View

Fuselage or Nacelle
RHS - Side View

Pylon
RHS - Side View

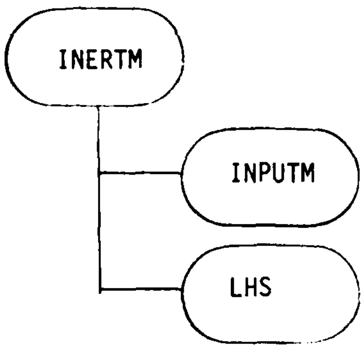
Figure 8. Component Local Coordinate Systems

$$[\kappa] = [m_{ii} \; \omega_i{}^2]$$

The generalized mass and stiffness matrices are saved in core along with the input structural damping and mode definition array for subsequent use. The array EMPHI which gives the inertial forces at the mass points for unit generalized response is calculated by

$$[EMPHI] = [M]\;[\phi_I]$$

for use in calculation of the integrated loads due to mass point motion. Figure 9 shows the principal routines of this module.



Controls module operation

Reads input data for module

Calculates generalized mass, stiffness and zeroes appropriate arrays

Figure 9. Inertial Module Routines

4. UNIT LOADS MODULE

The unit loads module serves to generate the matrices required to obtain integrated loads at all required locations on the vehicle. Its primary functions are to:

- Find the spatial location and orientation of each of the local beams, the network of which defines the load integrations for integrated loads and the spatial orientations of the integrated loads.

- Calculate the integrated loads due to unit inertial loads at the mass points and due to unit aerodynamic loads (motion dependent and gust) at the aerodynamic box load points and slender body load points.

- Calculate the integrated loads due to unit generalized responses in the modes for loads from mass point motion and aerodynamic box and slender body motion and thrust.

Figure 10 details the major routines of this module and a brief description of their functions. Input data required for this module consist of:

- An aero file.

- The number of local beams describing the possible load paths for internal loads, the AAS coordinates of the beam end points and their component definition numbers.

- The number of integrated loads desired, the local beam number each load is associated with, a load and component code for type and orientation, the AAS coordinate of each integrated load and the maximum allowable positive and negative load for each.

Routine	Description
LOAD	Dimensions arrays and controls module operation
INPUTL	Reads in required data for unit load matrices calculation
BEAM	Defines load paths and spatial orientations of integrated loads
GEØMMB - - - - MMBMLT	Forms integrated loads due to unit inertia forces
THRUST	Forms integrated loads due to unit thrust and generalized and symmetric forces due to unit thrust
SYMSØL	Checks for centerline integrated loads and forms symmetric and antisymmetric components
MSSPHI	Forms integrated inertial loads due to unit modal amplitudes
GEØMAB - - - - ABAMLT	Forms integrated loads due to unit aerodynamic panel loads
GEØMSB - - - - SBAMLT	Forms integrated loads due to unit slender body aerodynamic loads
ARØLØD - - - - ARØPHA	Forms integrated aerodynamic loads due to unit modal amplitudes

Figure 10. Unit Loads Module Routines

- the number of stresses required (if any) and the matrix relation between stresses and integrated loads.

- the number of mass point groups, the first and last mass point number and local beam number the loads from each group of mass points first enter and direction cosines (TLAMV) relating inertia motion to AAS motion.

- the number of aerodynamic box groups and the first and last box numbers and local beam number the loads from each group of aerodynamic boxes first enter.

- the number of slender body element aerodynamic groups and the first and last body element and local beam number the loads from each group of body elements first enter.

- number of engines and engine thrust location definition.

Routine LOAD dimensions and controls the operation of this module. INPUTL reads the required external input data which consist of beam network geometry, integrated load definition data, stress calculation matrix (if required), mass group definitions, aero box group definitions, and aero body group definitions. Group definitions of mass and aero points are used to form sparse matrices and to define which beam each group is associated with.

Routine BEAM defines the load paths by checking connections of the beam network and calculates the orientation in space of the beams.

A local beam coordinate system is used to define the orientation of the integrated loads. The location in space of any beam is determined from the end points of the beam defined as the inner and outer ends. Load integration

always passes from the outer ends to the inner ends of the local beams. The connection of these beam ends then defines the load path for determination of the integrated load which is the summation of all equilibrium loads 'outboard' of the integrated load station.

The spatial location and orientation of a beam segment is determined as follows:

- Let the beam segment be initially oriented parallel to the AAS system, with the beam Y axis along the AAS Y axis. The final orientation is determined by rotating through dihedral (positive about the X axis) then sweep (negative about the dihedrally rotated Z axis). The beam segment is now properly rotated and its end points are now as given by its endpoint coordinates in the AAS system.

- The direction cosine and transfer matrix relating the two coordinate systems ($\underset{\sim}{X}_R$ the reference or AAS system and $\underset{\sim}{X}_\ell$ the beam local system) are given by

$$\begin{Bmatrix} X_R \\ Y_R \\ Z_R \end{Bmatrix} = \begin{bmatrix} \lambda_S & \mu_S & 0 \\ -\lambda_D\mu_S & \lambda_D\lambda_S & -\mu_D \\ -\mu_S\mu_D & \lambda_S\mu_D & \lambda_D \end{bmatrix} \begin{Bmatrix} X_\ell \\ Y_\ell \\ Z_\ell \end{Bmatrix} + \begin{Bmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{Bmatrix}$$

  where $\underset{\sim}{X}_{IR}$ are the coordinates of the inner end of the beam segment given in the AAS system and λ_S, μ_S, λ_D, μ_D are the cosines and sines of the sweep and dihedral angles respectively.

  The AAS coordinates of the outer end of any beam are given by

$$\begin{Bmatrix} X_{OR} \\ Y_{OR} \\ Z_{OR} \end{Bmatrix} = \ell_B \begin{Bmatrix} \mu_S \\ \lambda_D\lambda_S \\ \lambda_S\mu_D \end{Bmatrix} + \begin{Bmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{Bmatrix}$$

where

$$\ell_B = \sqrt{(X_{OR} - X_{IR})^2 + (Y_{OR} - Y_{IR})^2 + (Z_{OR} - Z_{IR})^2}$$

$$= \sqrt{\Delta X_B^{\,2} + \Delta Y_B^{\,2} + \Delta Z_B^{\,2}}$$

Let

$$\Delta L = \sqrt{\Delta Y_B^{\,2} + \Delta Z_B^{\,2}}$$

Then the sweep and dihedral angles are

$$\mu_S = \frac{\Delta X_B}{\ell_B} \qquad \lambda_S = \frac{\Delta L}{\ell_B}$$

$$\mu_D = \frac{\Delta Z_B}{\Delta L} \qquad \lambda_D = \frac{\Delta Y_B}{\Delta L}$$

In the event that ΔL is zero, the dihedral angle by definition is + 90^0.

The inverse transformation from AAS to local coordinates is given by

$$\begin{Bmatrix} X_\ell \\ Y_\ell \\ Z_\ell \end{Bmatrix} = \begin{bmatrix} \lambda_S & -\lambda_D\mu_S & -\mu_S\mu_D \\ \mu_S & \lambda_D\lambda_S & \lambda_S\mu_D \\ 0 & -\mu_D & \lambda_D \end{bmatrix} \left(\begin{Bmatrix} X_R \\ Y_R \\ Z_R \end{Bmatrix} - \begin{Bmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{Bmatrix} \right)$$

$$= \left[\mathrm{TLAMM} \right] \begin{Bmatrix} X_R \\ Y_R \\ Z_R \end{Bmatrix} - \left[\mathrm{TLAMM} \right] \begin{Bmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{Bmatrix}$$

The local Y value of any point in the AAS system is given by

$$Y_\ell = \lfloor \mu_S \quad \lambda_D\lambda_S \quad \lambda_S\mu_D \rfloor \left(\begin{Bmatrix} X_R \\ Y_R \\ Z_R \end{Bmatrix} - \begin{Bmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{Bmatrix} \right)$$

$$= \lfloor TLAMY \rfloor \begin{Bmatrix} X_R \\ Y_R \\ Z_R \end{Bmatrix} + \lfloor \mu_S \quad \lambda_D\lambda_S \quad \lambda_S\mu_D \rceil \begin{Bmatrix} X_{IR} \\ Y_{IR} \\ Z_{IR} \end{Bmatrix}$$

which is required in the load calculations to insure that any equilibrium load which is inboard of an integrated load station is not included in the integration. The above rotation arrays are generated in BEAM.

The integrated loads are defined by specifying which local beam each is associated with, a load code which identifies it as one of the six possible shears and moments, the aircraft component it is associated with, its spatial location in the AAS system and the maximum positive and negative values. The location in space of the integrated load need not be on a beam, but its orientation will be vectorially parallel to the associated local beam system and load transfer will be made in a plane normal to the local Y axis and containing the load point.

The integrated loads due to inertial loads are found by transferring each inboard along the beam network. A sparsing procedure is employed in input data in that the local beam a group of mass point loads <u>first</u> enters is defined as well as the mass number range (first to last) of the mass point group.

The aerodynamic loads are similarly defined by entering first to last box numbers and first to last slender body element numbers and the beams they are first associated with. Box number sequencing and slender body sequencing definitions are found in Volume II describing the aerodynamic module details.

The process of transferring a group of equilibrium loads to an integrated

load station consists of: 1) converting the equilibrium loads in the AAS system to shears and moments at the integrated load point in the AAS system; 2) rotating the integrated loads into the local beam coordinate system; 3) rotating the resulting integrated loads properly to reflect the orientation of the equilibrium loads.

The load transfer is given by

$$\begin{Bmatrix} P_{XR} \\ P_{YR} \\ P_{ZR} \end{Bmatrix} = \begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix}, \quad \begin{Bmatrix} \overline{M}_{XR} \\ \overline{M}_{YR} \\ \overline{M}_{ZR} \end{Bmatrix} = \begin{Bmatrix} M_{XR} \\ M_{YR} \\ M_{ZR} \end{Bmatrix} + [DEL] \begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix}$$

where $\underset{\sim}{F}_{XR}$ and $\underset{\sim}{M}_{XR}$ are loads and moments respectively in the AAS coordinate system and

$$[DEL] = \begin{bmatrix} 0 & -\Delta Z_B & \Delta Y_B \\ \Delta Z_B & 0 & \Delta X_B \\ -\Delta Y_B & \Delta X_B & 0 \end{bmatrix}$$

where the transfer distances in the AAS system from the loads to integrated loads stations are

$$\Delta X_B = X_{RL} - X_{RB}, \quad \Delta Y_B = Y_{RL} - Y_{RB}, \quad \Delta Z_B = Z_{RL} - Z_{RB}$$

If sectional data is not input to the program, then $\underset{\sim}{M}_{XR} = 0$.

The integrated load rotation from AAS to local beam system is found from:

$$\begin{Bmatrix} P_{XB} \\ P_{YB} \\ P_{ZB} \end{Bmatrix} = [TLAMM] \begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix}$$

$$\begin{Bmatrix} M_{XB} \\ M_{YB} \\ M_{ZB} \end{Bmatrix} + \begin{bmatrix} TLAMM \end{bmatrix} \begin{bmatrix} DEL \end{bmatrix} \begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix} + \begin{bmatrix} TLAMM \end{bmatrix} \begin{Bmatrix} M_{XR} \\ M_{YR} \\ M_{ZR} \end{Bmatrix}$$

Where now the P and M are shears and moments in the local beam system coordinate directions (pounds and inch pounds).

The equilibrium inertial loads come from rotating the inertial loads from the orientations of the nodal deflection vectors used to the AAS system. Let

$$\begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix} = \begin{bmatrix} TLAMV \end{bmatrix} \begin{Bmatrix} F_{XI} \\ F_{YI} \\ F_{ZI} \end{Bmatrix}, \quad \begin{Bmatrix} M_{XR} \\ M_{YR} \\ M_{ZR} \end{Bmatrix} = \begin{bmatrix} TLAMM \end{bmatrix} \begin{Bmatrix} M_{XI} \\ M_{YI} \\ M_{ZI} \end{Bmatrix}$$

where $\underset{\sim}{F}_{XI}$ and $\underset{\sim}{M}_{XI}$ are inertia loads and moments in whatever orientation the idealization has assumed. (Note that often TLAMV will be the transpose of TLAMM for corresponding sets of mass points and beam these first enter). Then

$$\begin{Bmatrix} P_{XB} \\ P_{YB} \\ P_{ZB} \end{Bmatrix} = \begin{bmatrix} TLAMM \end{bmatrix} \begin{bmatrix} TLAMV \end{bmatrix} \begin{Bmatrix} F_{XI} \\ F_{YI} \\ F_{ZI} \end{Bmatrix}$$

$$\begin{Bmatrix} M_{XB} \\ M_{YB} \\ M_{ZB} \end{Bmatrix} = \begin{bmatrix} TLAMM \end{bmatrix} \begin{bmatrix} DEL \end{bmatrix} \begin{bmatrix} TLAMV \end{bmatrix} \begin{Bmatrix} F_{XI} \\ F_{YI} \\ F_{ZI} \end{Bmatrix} + \begin{bmatrix} TLAMM \end{bmatrix} \begin{bmatrix} TLAMV \end{bmatrix} \begin{Bmatrix} M_{XI} \\ M_{YI} \\ M_{ZI} \end{Bmatrix}$$

and TLAMV is input by the user for each mass group, and is seen to be the direction cosine matrix giving the components of the inertial loads in the AAS system.

The panel aerodynamic loads are defined positive (for a panel loaded in the usual fashion) up for horizontal surfaces and along the $-Y_R$ axis for vertical type surfaces. For an aerodynamic panel load F, let

$$\begin{Bmatrix} F_{XR} \\ F_{YR} \\ F_{ZR} \end{Bmatrix} = \begin{Bmatrix} \gamma_x \\ \gamma_y \\ \gamma_z \end{Bmatrix} \cdot F$$

Panel aerodynamic loads are assumed to act at the local mid-span point of each box and on the local quarter chord, and γ_x, γ_y, γ_z here are the direction cosines of the force in the AAS system.

Then

$$\begin{Bmatrix} \gamma_x \\ \gamma_y \\ \gamma_z \end{Bmatrix} = \begin{Bmatrix} 0 \\ -\mu_D \\ \lambda_D \end{Bmatrix}$$

where

$$\mu_D = \frac{\Delta z}{\sqrt{\Delta y^2 + \Delta z^2}} \qquad \lambda_D = \frac{\Delta y}{\sqrt{\Delta y^2 + \Delta z^2}}$$

and Δy and Δz are distances from inner to outer ends of the local aerodynamic box in the AAS system and are obtained from the aerodynamic module data.

Slender body aero forces are aligned in the $+ Z_R$ and $+ Y_R$ directions only, and act at the geometric center of each body.

The spatial orientation of an integrated load is seen to be fixed by the rotation process the local beam has undergone to arrive at its spatial

position as defined previously. Figure 11 shows the definition of the potential loads at a load station, and Figure 12 gives typical orientations for components of the vehicle. The load station itself is defined by specifying its AAS system coordinates and which local beam it is associated with.

Integrated loads on the centerline of the vehicle are checked to establish their symmetric and antisymmetric components and suitably modified for the one-half aircraft analysis.

Routine GEOMMB and MMBMLT form the matrices PINTH, PINTL, PINTS relating the equilibrium inertial loads to the integrated loads based on the preceding transformation. If sectional data is input to the program, these routines also form the matrices PINTT, PINTA, and PINTP for the sectional slope degrees of freedom. Routine MSSPHI forms the matrix PIQ relating generalized response to integrated loads.

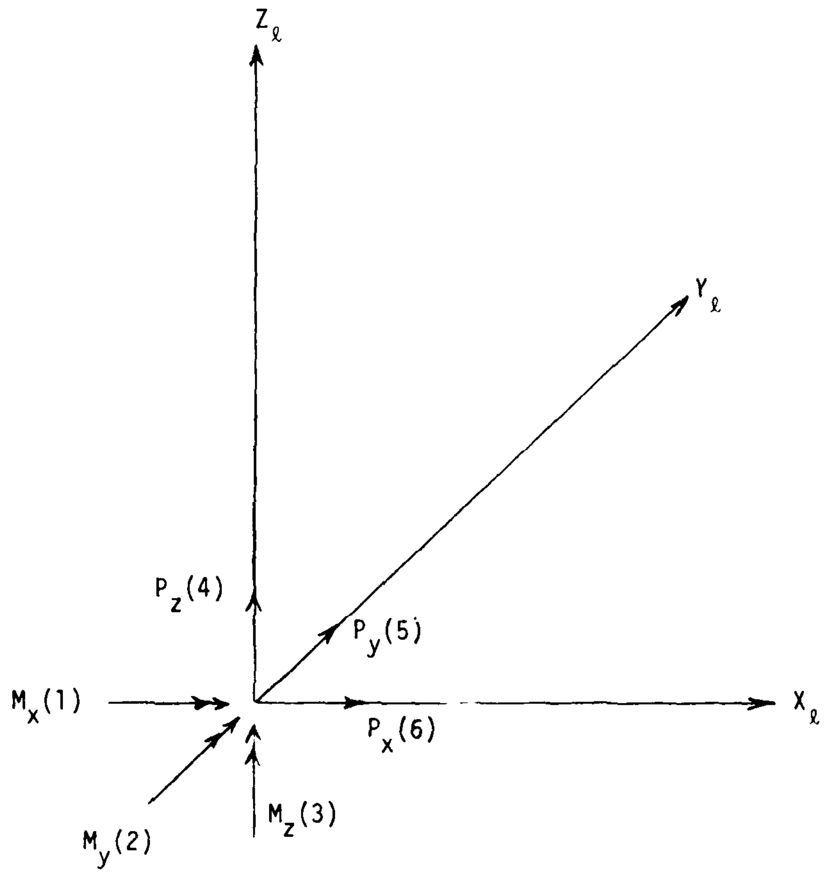
$$\left[PIQ \right] = \begin{bmatrix} PINTH \\ --- \\ PINTL \\ --- \\ PINTF \end{bmatrix} \left[EMPHI \right] + \begin{bmatrix} PINTT \\ PINTA \\ PINTS \end{bmatrix} \left[EMPHI \right]$$

where

$$\left[EMPHI \right] = \left[M \right] \left[\phi_I \right]$$

PIQ is saved for use in the unit gust loads module.

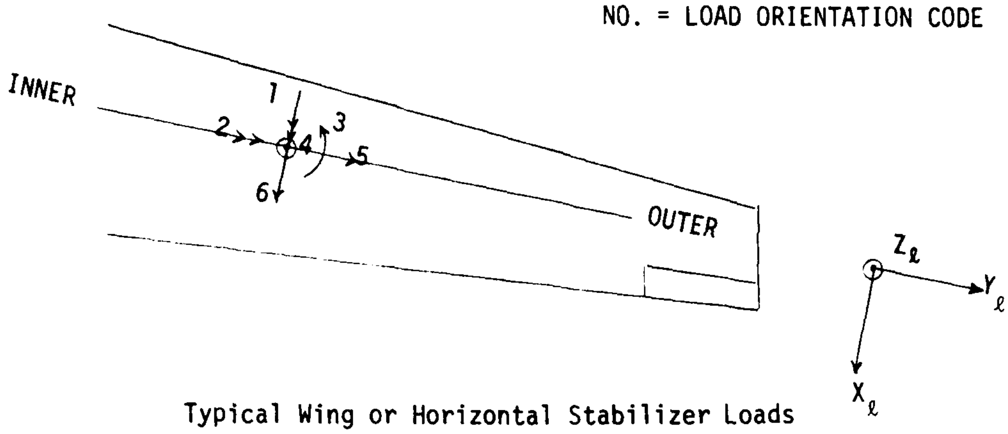
Routines GEOMAB, ABAMLT, GEOMSB, and SBAMLT form the matrices PINTP, PINTY, and PINTZ which relate unit aerodynamic forces at all box and slender body load points to the integrated loads using the transformations discussed above. Routines AROLOD and AROPHA form the matrices PAQS and PAQA which give the integrated loads for symmetric and antisymmetric motion dependent



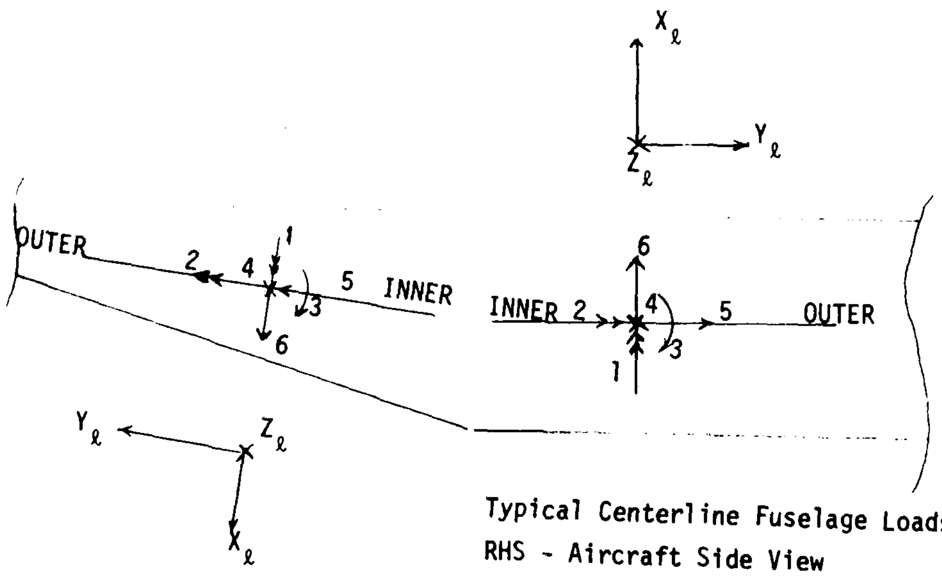
( ) = ORIENTATION CODE

Figure 11. Integrated Loads in Local Beam System

NO. = LOAD ORIENTATION CODE

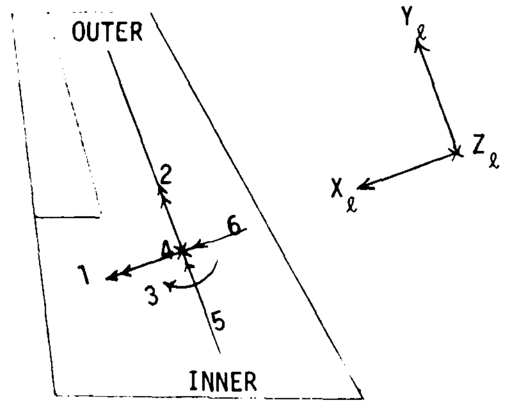


Typical Wing or Horizontal Stabilizer Loads
RHS - Aircraft Plan View
Component Code 1

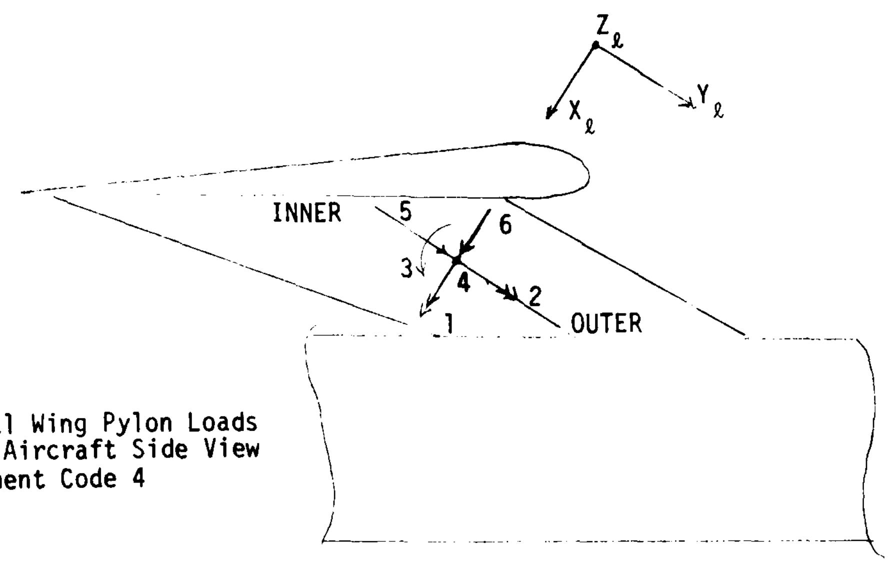


Typical Centerline Fuselage Loads
RHS - Aircraft Side View
Component Code 2

Figure 12. Sample Integrated Load Orientations

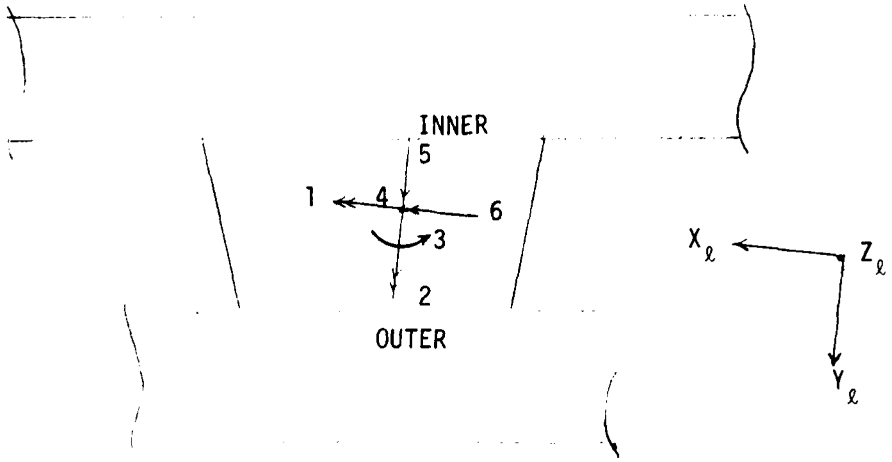


Typical Vertical Stabilizer Loads
RHS - Aircraft Side View
Component Code 3

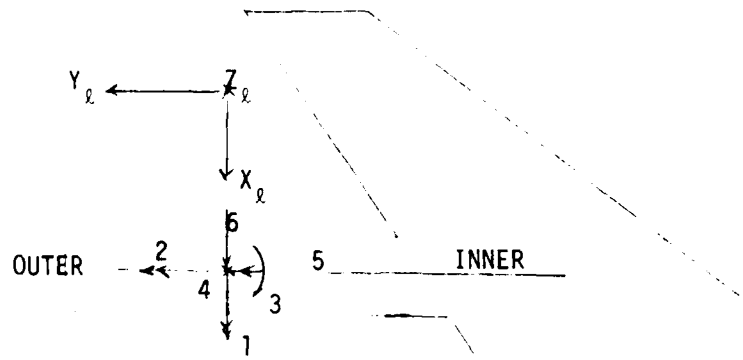


Typical Wing Pylon Loads
RHS - Aircraft Side View
Component Code 4

Figure 12 (cont). Sample Integrated Load Orientations



Typical Fuselage Side Pylon Pod Loads
RHS - Aircraft Plan View
Component Code 5



Typical Centerline Vertical Stabilizer Pylon Loads
RHS - Aircraft Side View
Component Code 6

Figure 12 (cont). Sample Integrated Load Orientations

aerodynamic forces, respectively, due to unit generalized amplitudes.

$$\left[PAQS(\kappa)\right] = \begin{bmatrix} PINTP \\ --- \\ PINTY \\ --- \\ PINTZ \end{bmatrix} \qquad \left[D_{\phi S}(\kappa)\right]$$

$$\left[PAQA(\kappa)\right] = \begin{bmatrix} PINTP \\ --- \\ PINTY \\ --- \\ PINTZ \end{bmatrix} \qquad \left[D_{\phi A}\ (\kappa)\right]$$

Where $D_{\phi S}$ and $D_{\phi A}$ are respectively the motion dependent aerodynamic box and body forces due to all symmetric and antisymmetric input modes. The matrices PAQS, PAQA, PINTP, PINTY, and PINTZ are saved for use in the unit gust loads and trim modules.

A stress matrix may be defined by the user which relates local stresses to the defined integrated loads:

$$\{\sigma\} = \left[STRESS\right] \{P\}$$

Routine THRUST calculates the integrated loads and generalized forces due to unit thrust loads for all engines specified. The components of the thrust loads are found from direction cosines ($\gamma_x, \gamma_y, \gamma_z$) determined by the line of action of the thrust which is found from the two mass points per engine thrust specified in the input. If only one mass station per engine is used with the sectional input data, then a dummy station must be specified to define the line of action of the thrust. The resulting forces are taken at the first input thrust mass:

$$\begin{Bmatrix} F_{XT} \\ F_{YT} \\ F_{ZT} \end{Bmatrix}_i = \left[TLAMV\ \right]^{-1} \begin{Bmatrix} \gamma_x \\ \gamma_y \\ \gamma_z \end{Bmatrix}$$

This aligns the forces with the inertial forces at the thrust mass point. The integrated loads due to the ith unit thrust then are

$$\left\{THRLOD_i\right\} = \begin{bmatrix} PINTF_i \\ - - - \\ PINTL_i \\ - - - \\ PINTH_i \end{bmatrix} \begin{Bmatrix} F_{XT} \\ F_{YT} \\ F_{ZT} \end{Bmatrix}_i$$

The generalized forces in the symmetric modes are given by premultiplying F_{XT}, F_{YT}, F_{ZT} by the symmetric modal row corresponding to the thrust mass:

$$\left\{THRGNF_i\right\} = \begin{bmatrix} PHIX_i \\ PHIY_i \\ PHIZ_i \end{bmatrix}^T \begin{Bmatrix} F_{XT} \\ F_{YT} \\ F_{ZT} \end{Bmatrix}_i$$

THRLØD and THRGNF are saved for later use in the trim module.

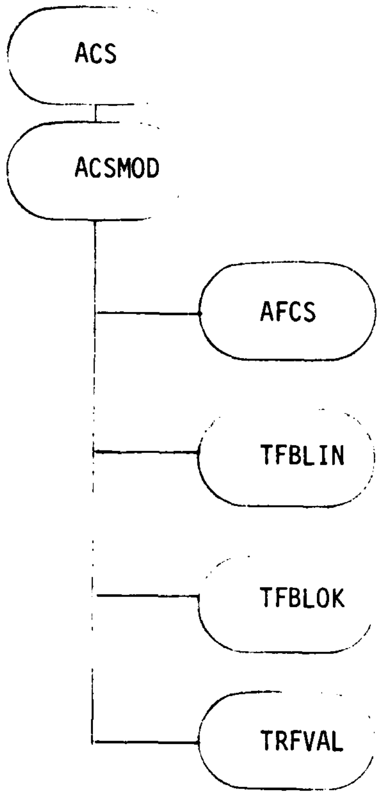
5. ACTIVE CONTROL MODULE

The active control module forms the data and arrays necessary to augment the equations of motion for the feedback effects. Input data required for this module consist of; 1) definition of the kinematics of the control system and 2) 'block' data defining the individual transfer functions. Data for symmetric and antisymmetric control are entered separately. The kinematics are described by the definition (for each symmetric and antisymmetric transfer function) of the mass point number and orientation (x, y, z) of the sensed motion, a scalar for scaling the transfer function and, the mode number of the input modal column which provides the control force. The 'block' input data consist of the definition of numerator and denominator polynomials which, when multiplied together, give the total output/input polynomial in s, where s is the LaPlace operator. The maximum order of any single block polynomial in the entire group is input as MXØBLK, and the maximum number of blocks in the largest transfer function as MXBLK. NTFS and NTFA define the total number of symmetric and antisymmetric transfer functions. Figure 13 details the major routines in this module.

The incremental commanded motion of a set of degrees of freedom by a sensor may be related to the sensed quantity by a transfer function T(s). For the frequency response solutions, s may be replaced by $i\omega$. For illustrative purposes, let the degrees of freedom be those deflections associated with the rotation of a control surface.

$$\{h_E\} = \{\phi_{\delta E}\}\,\delta$$

where $\phi_{\delta E}$ are the h_E deflections due to a unit rotation δ. The commanded rotation by an active systen then may be



Dimensions arrays and calls ACSMOD.

Controls routine operation and reads in control system definition data.

Forms special modal arrays from input inertial mode shapes.

Reads in block transfer function data and checks it.

Forms transfer function polynomials in frequency form for subsequent use.

Checks polynomials for one rad/sec frequency.

Figure 13 Active Control Module Routines

$$\delta_c = T(i\omega)h_s$$

where h_s is the amplitude of an inertial degree of freedom somewhere on the vehicle. In the modal solution, h_s is composed of motion due to aircraft rigid body perturbations plus elastic motion, and in terms of the generalized amplitudes q:

$$h_s = \lfloor\phi_s\rfloor \{q\}$$

The surface commanded deflection at any frequency ω then must be:

$$\{\Delta h_E\} = T(i\omega) \{\phi_{\delta E}\} \lfloor\phi_s\rfloor \{q\}$$

The total motion h_{ET} of the surface then is given by the sum of the elastic, rigid body and commanded motion:

$$\{h_E\} = \{\phi_{\delta E}\}\delta + T(i\omega) \{\phi_{\delta E}\} \lfloor\phi_{\delta j}\rfloor \{q\}$$

Since there may be many transfer functions and several control surfaces and many sensors, the incremental deflections may be written as

$$\{\Delta h\} = \sum_{j=1}^{NTF} T_j(i\omega) \left\{ \phi_{E_j} \right\} \lfloor\phi_{\delta j}\rfloor \{q\}$$

Note that the modal amplitude commanded by the control system and the transfer function must be consistent. That is, if the transfer function representation is given in terms of degrees/unit sensed and the control surface input modal amplitude is normalized to radian, then the transfer function must be scaled down by 57.3 degrees/radian.

In the active system module the data necessary to form the augmented motion is required in terms of specification, for each transfer function, of the data input number of the mode driven, the mass number corresponding to the sensed inertial degree of freedom, a code specifying which orientation of that degree of freedom (x, y or z) and a scalar multiplier for the

transfer function. This scalar multiplier may be used as a direction cosine for sensed orientations different from that of the mass point or for interpolation or for general scaling. The transfer functions are calculated by polynomial multiplication of 'block' polynomials describing the active elements of each path. Loops which describe symmetric control surface motion and antisymmetric motion are separately entered. A transfer function then has the form:

$$T(i\omega) = \frac{\sum_{n=1}^{NN} A_n \; (i\omega)^{n-1}}{\sum_{n=1}^{ND} B_n \; (i\omega)^{n-1}}$$

The generalized mass and aerodynamic matrices are augmented by the active system with the following matrices:

$$[\Delta m] = \sum^{NTF} T_\ell(i\omega) \; \{m_\ell\} \; \lfloor \phi_{Is_\ell} \rfloor$$

$$[\Delta \mathscr{D}(i\omega)] = \sum_{\ell=1}^{NTF} T_\ell(i\omega) \; \{\mathscr{D}_\ell(i\omega)\} \; \lfloor \phi_{Is_\ell} \rfloor$$

The integrated load matrices are augmented in a similar fashion:

$$[\Delta PIQ] = \sum_{\ell=1}^{NTF} T_\ell(i\omega) \; \{PIQ_\ell\} \; \lfloor \phi_{Is_\ell} \rfloor$$

$$\Delta \begin{bmatrix} PAQS(i\omega) \\ PAQA(i\omega) \end{bmatrix} = \sum_{\ell=1}^{NTF} T_\ell(i\omega) \begin{Bmatrix} PAQS_\ell(i\omega) \\ \hdashline PAQA_\ell(i\omega) \end{Bmatrix} \lfloor \phi_{Is_\ell} \rfloor$$

where m_ℓ, $\mathscr{D}_\ell$, PIQ_ℓ, $PAQS_\ell$, $PAQA_\ell$ are the columns of the matrices associated with the control surface mode associated with the ℓth transfer function and

ϕ_{Is_ℓ} is the modal row giving the sensed degree of freedom motion associated with the ℓth transfer function.

As an example of transfer function generation, the loop shown in Figure 14 commands a control surface deflection due to displacement and acceleration where

$$K_1 = \text{constant} = 0.75$$

$$K_2 = \frac{(s^2 + 3s + 20)}{(s^2 + 2s + 5)}$$

$$ACT = \frac{2500}{(s + 50)^2}$$

$$K_3 = \frac{1}{s + 1}$$

$$K_4 = \frac{(s+18)\ (s^2+21s+50)}{(s+10)\ (s^2+3s+25)}$$

$$K_5 = \frac{s + 12}{s + 5}$$

In terms of δ_c/h this loop may be represented by three simple transfer functions, each with five 'blocks' as shown in Figure 15 where

$$K_{4-1} = \frac{s + 18}{s + 10}$$

$$K_{4-2} = \frac{s^2+21s+50}{s^2+3s+25}$$

The transfer functions then are (shown by block input)

$$T_1(s) = (s^2)\left(\frac{1}{s+1}\right)\left(\frac{s + 18}{s + 10}\right)\left(\frac{s^2 + 21s + 50}{s^2 + 3s + 25}\right)\left(\frac{2500}{s+100s+2500}\right)$$

$$T_2(s) = (1.0)\ (1.0)\ \left(\frac{s + 18}{s + 10}\right)\left(\frac{s^2 + 21s + 50}{s^2 + 3s + 25}\right)\left(\frac{2500}{s^2+100s+2500}\right)$$

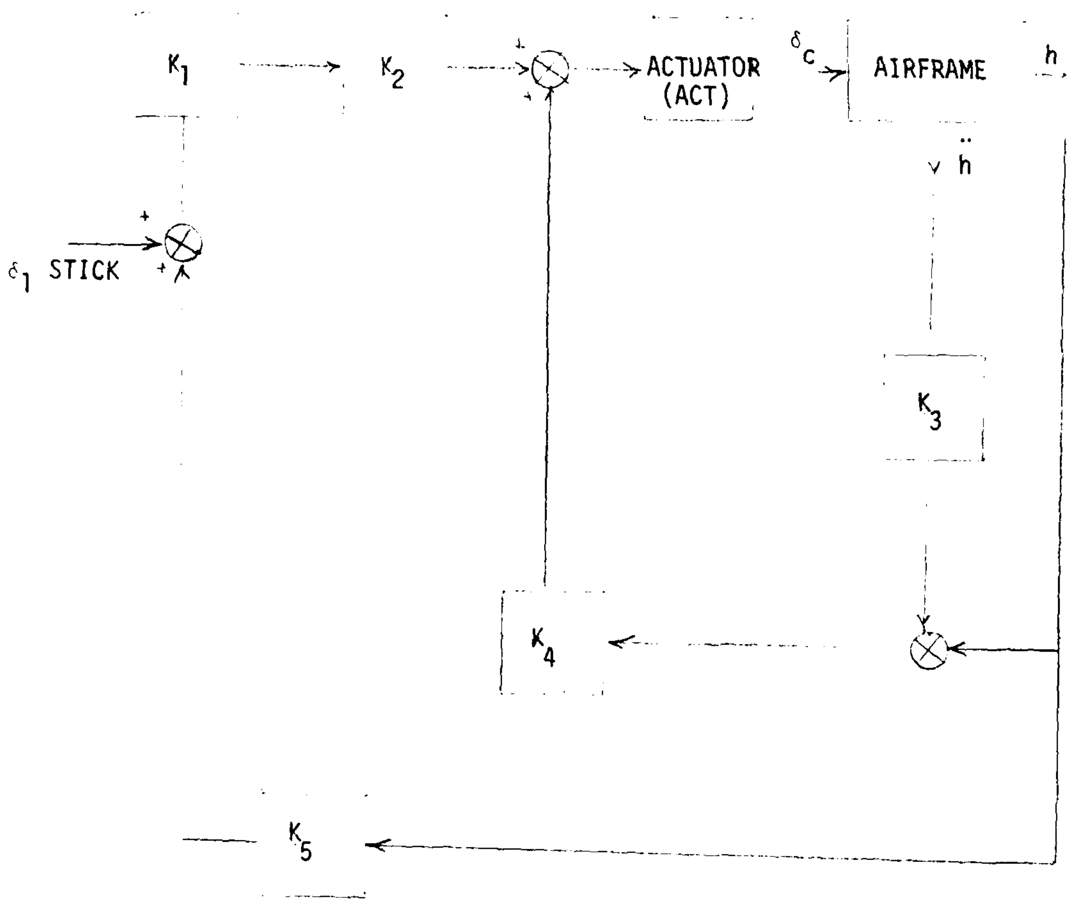
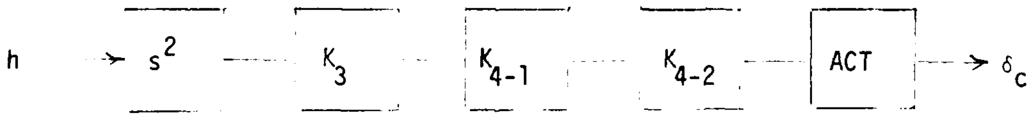
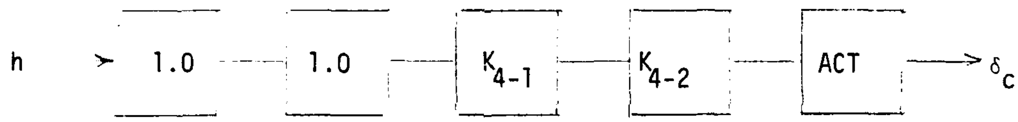


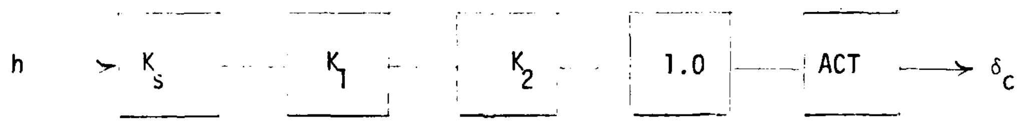
Figure 14. Sample High Gain Control Loop



TRANSFER FUNCTION NO. 1
ACCELERATION LOOP



TRANSFER FUNCTION NO. 2
DISPLACEMENT LOOP NO. 1



TRANSFER FUNCTION NO. 3
DISPLACEMENT LOOP NO. 2

Figure 15. Sample Control System Transfer Function Blocks

$$T_3(s) = (1.0)\left(\frac{s+12}{s+5}\right)(0.75)\left(\frac{s^2+3s+20}{s^2+2s+5}\right)\left(\frac{2500}{s^2+100s+2500}\right)$$

Routine AFCS forms the ϕ_{Is} arrays for symmetric and antisymmetric sensors. TFBLIN reads in the 'block' transfer function data and TFBLØK converts it to polynomials in powers of $i\omega$. TRFVAL prints out the transfer function polynomials evaluated at one rad/sec for checking.

6. FREQUENCY RESPONSE MODULE

The frequency response module solves the generalized equations of motion for the generalized response to a unit travelling gust in the frequency domain. The equations solved for each required frequency and blast orientation are

$$\left(-\omega^2 [m] - \bar{q} \left[\mathcal{A}(i\omega)\right] + (1 + ig) \lceil \kappa \rfloor\right) \{q(i\omega)\} = \frac{\rho V}{2} \{\mathcal{F}_g(i\omega)\}$$

where:

m is the generalized mass matrix

$\mathcal{A}(i\omega)$ is the generalized aerodynamic force matrix due to motion

κ is the generalized stiffness matrix

g is the structural damping (only in the elastic modes)

$\bar{q}$ is the dynamic pressure (psi)

$q(i\omega)$ is the generalized response

$\mathcal{F}_g(i\omega)$ is the generalized gust vector for a specific orientation

ρ is the ambient density ($lb\text{-}sec^2/ft^4$)

V is the aircraft velocity (fps)

In the module the above equations are solved for all blast orientations available simultaneously, passing automatically through the routines twice, once for symmetric solutions and once for antisymmetric solutions.

Input data required consist of the flight altitude and velocity, the structural damping in each mode, an aerodynamic tape, and the definition of frequencies for solution. The input frequencies for solution should cover the entire range of given elastic modes of the free-free aircraft and out to the highest frequency obtainable from the available aerodynamic solutions. The major routines in this module are shown in Figure 16.

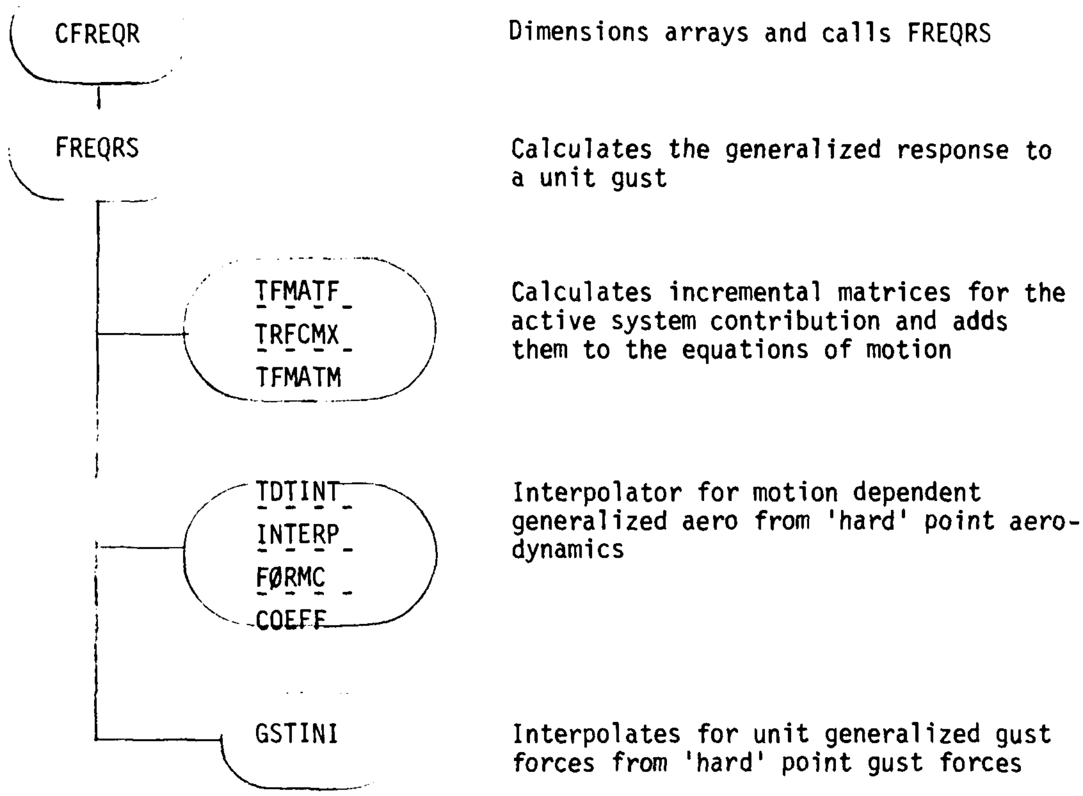


Figure 16. Frequency Response Module Routines

Routine FREQRS forms and solves the equations one frequency at a time and saves the solutions. Routines TFMATM, TFMATF and TRFCMX calculate the incremental generalized mass and generalized motion dependent aerodynamic forces due to the active system feedback, where the incremental generalized mass matrix is given by:

$$[\Delta m(i\omega)] = \sum_{\ell=1}^{NTF} T_\ell(i\omega)\ \{m_j\}\ \lfloor \phi_{Is_\ell} \rfloor$$

and the incremental generalized aerodynamic matrix by

$$[\Delta \mathscr{Q}(i\omega)] = \sum_{\ell=1}^{NTF} T_\ell(i\omega)\ \{\mathscr{Q}_j(i\omega)\}\ \lfloor \phi_{Is_\ell} \rfloor$$

where

NTF = number of transfer functions for symmetric or antisymmetric motion

$T_\ell(i\omega)$ = the ℓth transfer function evaluated at ω (in routine TRFCMX)

m_j = the jth column of the generalized mass matrix corresponding to the jth mode, the driving mode (a control surface rotation mode)

$\mathscr{Q}_j(i\omega)$ = the similar column of the aerodynamic matrix

ϕ_{Is_ℓ} = the modal row giving the ℓth sensed degree of freedom motion in terms of generalized response

Routines TDTINT and INTERP form the motion dependent generalized aerodynamic forces at specific frequencies by spline interpolation from the aerodynamic matrices at the 'hard' points, where

$$[\mathscr{Q}(i\omega)] = \sum_{j=1}^{NK} C_j(\omega)\ [\mathscr{Q}_j(i\omega j)]$$

Routine FORMC and COEFF form the coefficients $C_j(\omega)$ as function of the 'hard' point reduced frequencies and the desired frequency for solution. Routine GSTINI interpolates for the generalized gust forces, where

$$\mathscr{F}_g(i\omega) = \begin{bmatrix} \text{SPLHP} \\ --- \\ \text{SPLHZ} \\ --- \\ \text{SPLHY} \end{bmatrix}^T \begin{Bmatrix} F_{gP}(i\omega) \\ F_{gZ}(i\omega) \\ F_{gY}(i\omega) \end{Bmatrix}$$

and the SPLHP, SPLHZ, and SPLHY are obtained from the aero tape and are the generalized forces due to local box gust, body Z gust forces and body Y gust forces respectively. F_{gP}, F_{gZ} and F_{gY} are the aerodynamic element gust forces which are obtained from the 'hard' point aerodynamic forces by interpolation:

$$F_g = e^{\phi_G} \sum_{j=1}^{NK} C_j(i\omega)\, R_G(i\omega_j)$$

$$\phi_G = \sum_{j=1}^{NK} C_j(i\omega)\, \phi_G(i\omega)$$

where R_G and ϕ_G are the moduli and phase angle of the local gust force.

The local gust forces for symmetric and antisymmetric solutions are saved for use in the unit gust load module along with the generalized response solutions and the interpolation coefficients.

7. UNIT GUST LOAD MODULE

The unit gust load module calculates the integrated loads and accelerations due to unit travelling gusts at specific orientations. Input data consist of a unit load tape, an aerodynamic tape and a frequency response tape. The routines are as shown in Figure 17.

The routine CFRLØD dimensions the necessary arrays and calls FRLØAD. FRLØAD forms the symmetric and antisymmetric oscillatory integrated loads and accelerations in the frequency domain due to a unit gust, orientation by orientation. The oscillatory loads at a specific frequency and orientation are the sum of the inertial loads and motion dependent aerodynamic and gust (blast) aerodynamic loads:

$$\begin{Bmatrix} P_S(i\omega) \\ \hline P_A(i\omega) \end{Bmatrix} = \omega^2 \, [PIQ] \begin{Bmatrix} q_S(i\omega) \\ \hline q_A(i\omega) \end{Bmatrix} + \bar{q} \begin{bmatrix} PAQS(i\omega) \\ \hline PAQA(I\omega) \end{bmatrix} \begin{Bmatrix} q_S(i\omega) \\ \hline q_A(i\omega) \end{Bmatrix}$$

$$+ \rho \frac{V}{2} \, [PINTP] \begin{Bmatrix} F_{P_S}(i\omega) \\ \hline F_{P_A}(i\omega) \end{Bmatrix} + \rho \frac{V}{2} \, [PINTY] \begin{Bmatrix} F_{Y_S}(i\omega) \\ \hline F_{Y_A}(i\omega) \end{Bmatrix}$$

$$+ \rho \frac{V}{2} \, [PINTZ] \begin{Bmatrix} F_{Z_X}(i\omega) \\ \hline F_{Z_A}(i\omega) \end{Bmatrix}$$

The accelerations at a specific frequency are given by:

$$\begin{Bmatrix} a_S \\ \hline a_A \end{Bmatrix} = -\omega^2 \begin{bmatrix} \Phi I_S & 0 \\ \hline 0 & \Phi I_A \end{bmatrix} \begin{Bmatrix} q_S(i\omega) \\ \hline q_A(i\omega) \end{Bmatrix}$$

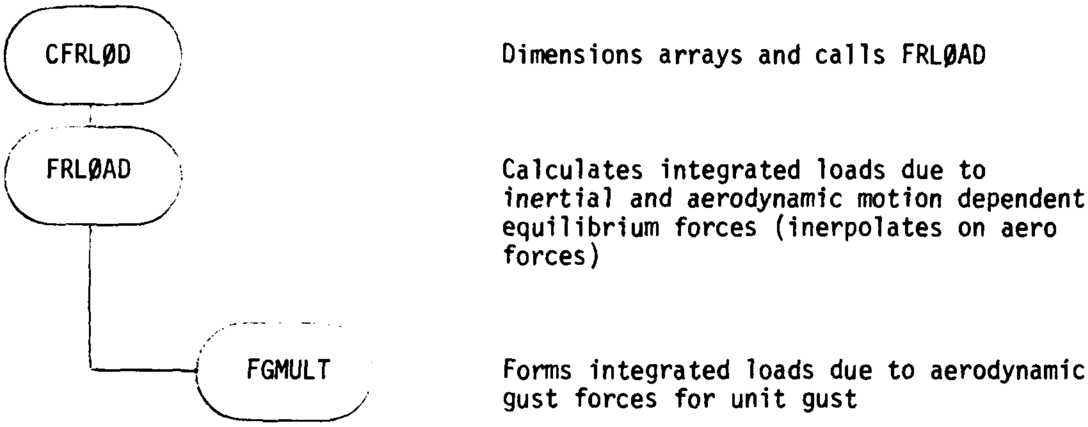


Figure 17. Unit Gust Load Module Routines

The generalized response solutions q_S and q_A are available from the frequency response module. PIQ, PINTP, PINTY, and PINTZ are frequency independent and available from the unit loads module.

PAQS and PAQA are frequency dependent and available from the unit loads module for only specific frequencies (the 'hard' points). Spline interpolation is used to obtain these arrays at all other frequencies, using the same coefficients which were generated in the frequency response module. That is

$$\begin{bmatrix} PAQS(i\omega) \\ \hdashline PAQA(i\omega) \end{bmatrix} = \sum_{j=1}^{NK} C_j(\omega) \begin{bmatrix} PAQS(i\omega_j) \\ \hdashline PAQA(i\omega_j) \end{bmatrix}$$

The symmetric and antisymmetric local gust forces F_{PS}, F_{PA}, F_{ZS}, F_{ZA}, F_{YS}, and F_{YA} are obtained from the frequency response module output. Routine FGMULT carries out the premultiplication by the appropriate PINT arrays.

The active system contributions to the loads are calculated by augmenting the PIQ, PAQS and PAQA arrays in the same fashion as that found in the frequency response module.

8. TRIM MODULE

The trim module trims the aircraft for a specified flight condition. A flight condition is defined as flight at specified altitude, speed (hence Mach number), maneuver and thrust. The principal routines used are CTRIM and TRIM, where CTRIM dimensions the arrays and calls the TRIM routine which carries out the trim solution. CTRIM is called from the driving routine of the blast and time response modules. Input data for this module consist of an aerodynamic tape, a unit loads tape and load factor, maneuver, rate of climb and engine thrust:

n = total load factor for flight (1.0 for trimmed level flight)

KMAN = maneuver constant (0 level flight, 1 for pullout, 2 for turns)

$\dot{Z}$ = EFAS rate of climb (or descent) in a turn (ft/sec)

Flight altitude and velocity for the condition are obtained from the unit gust load tape. Figure 18 details the major routines found in this module.

The linearized force equations of motion for the solution of trimmed flight loads are:

$$\{F\} = [K_{FF}]\{h\} = \{F_I\} + \{F_A\} + \{F_T\}$$

where

K_{FF} = free-free stiffness matrix

F_I = inertial forces

F_A = aerodynamic forces

F_T = thrust forces

These solutions assume that drag equals the forward component of thrust and that the aircraft is either in a steady climbing (or descending) turn or in

CTRIM	Dimensions arrays and calls TRIM
TRIM	Calculates trim parameters and trimmed flight integrated loads

Figure 18. Trim Module Routines

level flight or a symmetric pullout.

The inertial force distribution for the above restrictions are given by

$$\left\{ F_I \right\} = n\ g\ [M] \left\{ \phi_{Ih} \right\}$$

where

n = load factor (ratio of lift to weight) and the local accelerations relative to rigid body oscillations are small

M is the distributed mass matrix

ϕ_{Ih} is the rigid body plunge mode for the inertial degrees of freedom

The thrust forces are given by

$$\left\{ F_T \right\} = - [\lambda_{TH}]\ T_H$$

where: λ_{TH} is a matrix of direction cosines giving the components of the thrust vectors aligned with the appropriate inertial degrees of freedom and was generated for unit thrust loads in the unit load module

T_H is the engine thrusts for the flight condition (symmetric only)

The aerodynamic forces are given by:

$$\left\{ F_A \right\} = \bar{q}\ [D] \left\{ h_A \right\} + \bar{q}\ [\dot{D}] \left\{ \dot{h}_A \right\}$$

where

$\bar{q}$ is the flight dynamic pressure

h_A are the aerodynamic point deflections

$\dot{h}_A$ are the aerodynamic point velocities

D, $\dot{D}$ are the aerodynamic AIC's relating aerodynamic force to point displacement and point velocity.

The aerodynamic point deflections are caused by rigid body motion,

aircraft jig shape (twist, camber and relative surface offset from the body axes, but not dihedral), control surface position, and elastic deformations. The aerodynamic point velocities are due to the constant rotational velocity of the vehicle in the prescribed maneuvers. Then:

$$\{h_A\} = \{\phi_{AJS}\} + \{\phi_{AJA}\} + \{\phi_{A\alpha}\}\alpha_o + \{\phi_{A\psi}\}\beta_o + \{\phi_{A\delta_E}\}\delta_E$$

$$+ \{\phi_{A\delta_R}\}\delta_R + \{\phi_{A\delta_A}\}\delta_A + [\phi_{AES}]\{q_{ES}\} + [\phi_{AEA}]\{q_{EA}\}$$

$$= [\phi_{AS} \mid \phi_{AA}] \begin{Bmatrix} q_S \\ q_A \end{Bmatrix}$$

and

$$\{\dot{h}_A\} = \bar{P}\{\phi_{A\theta}\} + \bar{P}\Delta z\{\phi_{A\ell}\} + \bar{Q}\{\phi_{A\alpha}\} + \bar{Q}\Delta x\{\phi_{Ah}\} + \bar{R}\{\phi_{A\psi}\} - \bar{R}\Delta x\{\phi_{Ah}\}$$

$$= [\dot{\phi}_{AS} \mid \dot{\phi}_{AA}] \begin{Bmatrix} \dot{q}_S \\ \dot{q}_A \end{Bmatrix}$$

where

$\phi_{AJS,A}$ = jig modes, symmetric and antisymmetric

$\phi_{A\alpha}$ = rigid body pitch mode

$\phi_{A\psi}$ = rigid body yaw mode

$\phi_{A\theta}$ = rigid body roll mode

$\phi_{A\delta_E}$ = symmetric trim mode (elevator, horizontal stabilizer, canard)

$\phi_{A\delta_R}$ = yaw control surface mode (usually rudder)

$\phi_{A\delta_A}$ = roll control surface mode (usually aileron)

ϕ_{AES}, ϕ_{AEA} = symmetric and antisymmetric aerodynamic mode shapes from the elastic modes

Δx, Δz = distances from the reference point for the rigid body modes and the c.g., and are obtained from the appropriate elements of the generalized mass matrix

$\bar{P}$ = steady roll rate about the cg

$\bar{Q}$ = steady pitch rate about the cg

$\bar{R}$ = steady yaw rate about the cg

α_o, β_o = trim pitch and yaw angles

δ_E, δ_R, δ_A = trim control surface positions, elevator, rudder, aileron

q_{ES}, q_{EA} = symmetric and antisymmetric elastic modal amplitudes

and h, ℓ, α, θ, ψ refer to vertical and lateral deflection and pitch, roll, yaw rotation, respectively.

Integration of all pertinent forces then gives the generalized force equations of motion, where aircraft moments are taken about the reference point for the rigid body modes:

$$\begin{Bmatrix} F_z \\ M_y \\ \mathcal{F}_{\substack{\text{elastic} \\ \text{sym.}}} \end{Bmatrix} = [\phi_h \quad \phi_\alpha \quad \phi_{ES}]^T \{F\} \qquad \begin{Bmatrix} F_y \\ M_x \\ M_z \\ \mathcal{F}_{\substack{\text{elastic} \\ \text{antisym.}}} \end{Bmatrix} = [\phi_\ell \quad \phi_\theta \quad \phi_\psi \quad \phi_{EA}]^T \{F\}$$

Taking advantage of vehicle symmetry and substituting for displacements and velocities, and distinguishing between inertial and aerodynamic degrees of freedom and collecting into partitions of generalized matrices which are available from past module calculations, the equations of motion become:

Symmetric set:

$$-\bar{q}\begin{bmatrix} \mathcal{Z}_{h\alpha} & \mathcal{Z}_{h\delta_E} & \mathcal{Z}_{hE} \\ \mathcal{Z}_{\alpha\alpha} & \mathcal{Z}_{\alpha\delta_E} & \mathcal{Z}_{\alpha E} \\ \mathcal{Z}_{E\alpha} & \mathcal{Z}_{E\delta_E} & (\mathcal{Z}_{EE} - \frac{1}{\bar{q}}\kappa_{EE}) \end{bmatrix} \begin{Bmatrix} \alpha_o \\ \delta_E \\ q_{ES} \end{Bmatrix} = ng \begin{Bmatrix} m_{hh} \\ m_{\alpha h} \\ m_{Eh} \end{Bmatrix} - [THRGNF] \{T_H\}$$

$$+ \bar{q} \begin{Bmatrix} \mathscr{D}_{hJ} \\ \mathscr{D}_{\alpha J} \\ \mathscr{D}_{EJ} \end{Bmatrix} + \bar{q} \begin{bmatrix} \dot{\mathscr{D}}_{h\alpha} & \dot{\mathscr{D}}_{hh} \\ \dot{\mathscr{D}}_{\alpha\alpha} & \dot{\mathscr{D}}_{\alpha h} \\ \dot{\mathscr{D}}_{E\alpha} & \dot{\mathscr{D}}_{Eh} \end{bmatrix} \begin{Bmatrix} \bar{Q} \\ \bar{Q}\Delta x \end{Bmatrix}$$

Antisymmetric set:

$$\bar{q} \begin{bmatrix} \mathscr{D}_{\ell\psi} & \mathscr{D}_{\ell\delta_R} & \mathscr{D}_{\ell\delta A} & \mathscr{D}_{\ell E} \\ \mathscr{D}_{\theta\psi} & \mathscr{D}_{\theta\delta_R} & \mathscr{D}_{\theta\delta A} & \mathscr{D}_{\theta E} \\ \mathscr{D}_{\psi\psi} & \mathscr{D}_{\psi\delta_R} & \mathscr{D}_{\psi\delta A} & \mathscr{D}_{\psi E} \\ \mathscr{D}_{E\psi} & \mathscr{D}_{E\delta_R} & \mathscr{D}_{E\delta A} & \left(\mathscr{D}_{EE} - \frac{1}{\bar{q}} \kappa_{EE}\right) \end{bmatrix} \begin{Bmatrix} \beta_o \\ \delta_R \\ \delta_A \\ q_{EA} \end{Bmatrix} = -\bar{q} \begin{Bmatrix} \mathscr{D}_{\ell J} \\ \mathscr{D}_{\theta J} \\ \mathscr{D}_{\psi J} \\ \mathscr{D}_{EJ} \end{Bmatrix}$$

$$+ \bar{q} \begin{bmatrix} \dot{\mathscr{D}}_{\ell\theta} & \dot{\mathscr{D}}_{\ell\ell} & \dot{\mathscr{D}}_{\ell\psi} \\ \dot{\mathscr{D}}_{\theta\theta} & \dot{\mathscr{D}}_{\beta\ell} & \dot{\mathscr{D}}_{\theta\psi} \\ \dot{\mathscr{D}}_{\psi\theta} & \dot{\mathscr{D}}_{\psi\ell} & \dot{\mathscr{D}}_{\psi\psi} \\ \dot{\mathscr{D}}_{E\theta} & \dot{\mathscr{D}}_{E\ell} & \dot{\mathscr{D}}_{E\psi} \end{bmatrix} \begin{Bmatrix} \bar{P} \\ \bar{P}\Delta z - \bar{R}\Delta x \\ \bar{R} \end{Bmatrix}$$

The elements of the above equations are obtained from the available generalized matrices by extraction.

The generalized aerodynamics for velocity are obtained from the lowest non-zero reduced frequency (k_ℓ) complex matrices:

$$\dot{\mathscr{D}} = \left(\frac{b_R}{k_\ell V}\right) \text{Imag} \left(\mathscr{D}(k_\ell)\right)$$

where b_R is the reference semichord from the aerodynamic module.

The value of n, $\bar{P}$, $\bar{Q}$ and $\bar{R}$ are obtained from input data specifying the trim condition desired. For level flight or a level pullout at specified load factor:

$$\bar{Q} = \frac{(n - 1)\, g}{V}$$

$$\bar{P} = \bar{R} = 0$$

where the load factor n is input.

For climbing (or level or descending) turn:

$$\bar{Q} = \frac{ng}{V}\left(1 - \frac{1}{n^2}\right), \quad \phi_B = \cos^{-1}\left(\frac{1}{n}\right)$$

$$\bar{P} = -\frac{\theta_c}{V} g \tan \phi_B$$

$$\bar{R} = \frac{g}{V} \sin \phi_B$$

where ϕ_B is the bank angle calculated from the input load factor and θ_c is the climb angle. θ_c is calculated from input rate of climb ($\dot{Z}$) and R is calculated from the bank angle:

$$\theta_c = \sin^{-1}\left(\frac{\dot{Z}}{V}\right)$$

$$R = \frac{V^2}{g \tan \phi_B}$$

The symmetric and antisymmetric integrated loads for the trimmed flight solution are given by

$$\left\{P_{STRIM}\right\} = n\, g \left\{PIQ(\phi_h)\right\} + \bar{q}\,[PAQS(k = 0)] \left\{q_S\right\} + \bar{q}\left(\frac{b_R}{k_\ell V}\right) \text{Imag}\,[PAQS(k_\ell)] \left\{\dot{q}_S\right\} + [THRLØD] \left\{T_H\right\}$$

$$\left\{P_{ATRIM}\right\} = \bar{q}\,[PAQA(k = 0)] \left\{q_A\right\} + \bar{q}\left(\frac{b_R}{k_\ell V}\right) \text{Imag}\,[PAQA(k_\ell)] \left\{\dot{q}_A\right\}$$

Additional aerodynamic data are output for the trim condition. These are the load distributions in varying degrees of detail. The aerodynamic

parameters and geometric data printed include the following:

1. Lifting pressures and their center locations in each box on all lifting surfaces;

2. Lift coefficient, moment coefficient (about 1/4-chord), and center of pressure on each lifting surface strip as a function of spanwise location;

3. Spanwise distribution of loading (in the form $c_\ell c/\bar{c}$ on each lifting surface as a function of span;

4. Vertical and lateral running loads on slender bodies (force per unit length) are output as a function of longitudinal location (body element centers) on all bodies;

5. Total force and moment coefficients for the entire aircraft and for the lifting surfaces separately.

The equations that are used in the calculation of the various aerodynamic loading coefficients are given in Section VI, Part 1 of Vol. II of this report.

9. BLAST AND TIME RESPONSE MODULES

These modules establish the blast gust time and density history at the moving AAS origin of the aircraft and the Fourier transforms of the product of velocity and the local density, and calculate the frequency response of the aircraft due to the blast from the unit gust frequency response and acceleration solutions. (The trim module is called from the driving routine CGUSTR). The program then transforms these gust and acceleration reponses back to the time domain. Summation of the trim loads and the time histories of the perturbation loads gives the total loads on the vehicle as a function of time. The maximum positive and negative loads are compared to the input allowables and the solution iterated for critical range (if desired).

Input data required for this module consist of:

A unit gust load tape, a unit load tape and:

NØRMAX = the number of orientations to be analyzed

NØR = the orientation definition number for each orientation analyzed

REST = the initial slant range estimate for each orientation analyzed

EFR = burst yield (kilotons)

TIMEMX = maximum time in seconds of the response time history

KLPT = iteration control for establishing critical range:

- 0, for no iteration
- 1, for iteration

KGRD = ground reflection control:

- 0, for no reflection
- 1, for including reflection

HGRD = height above sea level of the ground (ft)

KLØAD = allowable load modification constant:

0, use maximum allowable loads from unit loads tape,

1, input and modify allowables

STALDS(I,J) = maximum positive (j = 7) and negative (J = 8) allowable loads for control range (entered only if NEWMAX = 1)

NCRITS = control constant for determining allowable range based on critical stresses (is NSTRSS not zero)

0, no critical stress

1, input and use critical stress for range determination

ALLOWS(I,J) = maximum positive (J = 1) and negative (J = 2) allowable stresses (entered if NCRITS non zero)

Gust orientations for the blast intercept and their code numbers are shown in Figure 19. A side directed burst orientation may be developed from its symmetric counterpart on the opposite side, hence the need for fewer asymmetric orientations in the aero and response modules. A tabular correspondence between the orientation numbers of the aero module and the blast module is used to take advantage of this. Table 3 gives the standard direction cosines for the standard orientations.

The substantial difference in this analysis procedure and that of the VIBRA-4 program is seen to be the use of Fourier transforms to and from the frequency domain to establish the time histories of loads rather than piecewise integration in the time domain. This procedure is necessary because the complex three dimensional unsteady aerodynamic solutions are known only for constant amplitude oscillatory motion. The Fourier transform process properly accounts for the time lags of the blast induced gust impingement across the aircraft spatially in that, in the limit, every possible phase lag across

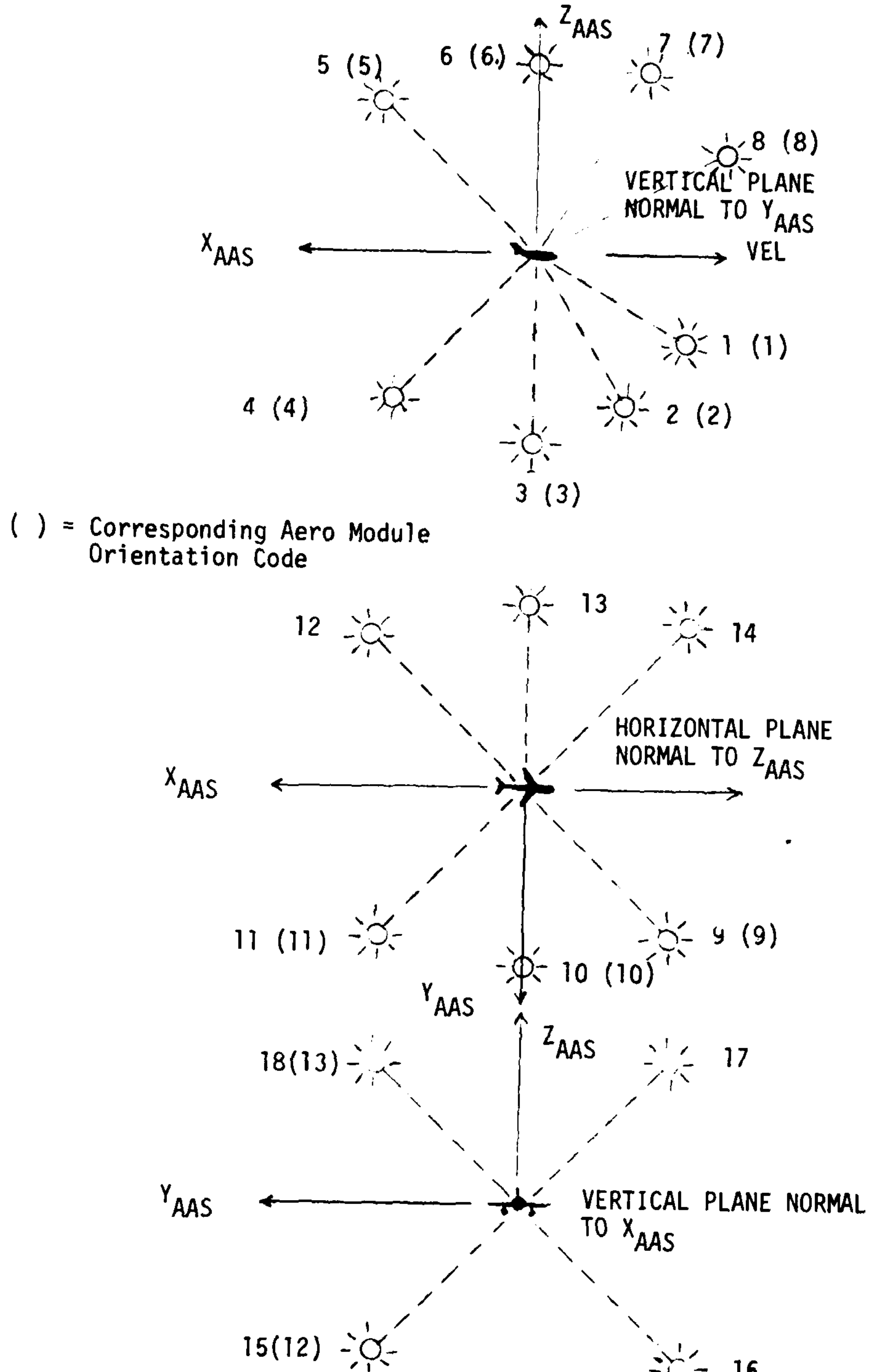


Figure 19. Blast Orientations for Blast Module

TABLE 3

DIRECTION COSINES FOR STANDARD ORIENTATIONS

ORIENTATION NUMBER	γ_x	γ_y	γ_z
1	0.8660254	0.0	0.50
2	0.50	0.0	0.8660254
3	0	0.0	1.0
4	-0.7071068	0.0	0.7071068
5	-0.7071068	0.0	-0.7071068
6	0	0.0	-1.0
7	0.50	0.0	-0.8660254
8	0.8660254	0.0	-0.50
9	0.7071068	-0.7071068	0.0
10	0	-1.0	0.0
11	-0.7071068	-0.7071068	0.0
12	-0.7071068	0.7071068	0.0
13	0	1.0	0.0
14	0.7071068	0.7071068	0.0
15	0.0	0.7071068	0.7071068
16	0.0	-0.7071068	0.7071068
17	0.0	-0.7071068	-0.7071068
18	0.0	0.7071068	-0.7071068

the surfaces is accounted for in the frequency domain by specification of all frequencies of a unit gust traveling across the vehicle of given speed and direction. The Fourier transform of the gust time history establishes the amplitudes and lags of the forces at all frequencies (in the limit) and the inverse transform results in the time history. The method assumes a linear system of equations, which is consistent with the assumption made for the aerodynamic forces and that:

1. The blast wave travels at sonic speed.
2. The material velocity (gust) at any fixed distance behind the shock front is invariant as it passes across the vehicle.
3. Peak structural loads occur before the aircraft trajectory has changed significantly and thus the material velocity distribution behind the shock front is adequately predicted by the undisturbed aircraft flight path and its distance from the shock front.
4. The incremental angle of attack due to gust locally on the vehicle is sufficiently small such that the linear aerodynamic theory is adequate.

The transform procedure follows from the definition of the traveling gust function from Volume II. The downwash at any point on the vehicle resulting from a unit amplitude sinusoidally oscillating material velocity of frequency ω and travelling at sonic speed is given by

$$w(x, \bar{t}) = \theta \cdot \mathrm{Re} \left\{ \left[\cos\frac{\bar{k}\ell}{b} - i \sin \frac{\bar{k}\ell}{b}\right] e^{\,i\omega\bar{t}} \right\}$$

where $\bar{k} = \dfrac{kM}{b(1+\gamma_x M)}$

and

θ = velocity component of unit amplitude gust normal to surface

k = reduced frequency

M = free stream Mach number

b = reference semichord

γ_x = direction cosine of the blast wave front with respect to the X_{AAS} axis

$\bar{t}$ = shifted time

and

$$\ell = \gamma_x x + \gamma_y y + \gamma_z z$$

where

$x = X_{AAS}$ coordinate of the point

$y = Y_{AAS}$ coordinate of the point

$z = Z_{AAS}$ coordinate of the point

γ_y, γ_z = direction cosines of the blast wave with respect to the Y_{AAS} and Z_{AAS} axes, respectively.

The shifted time $\bar{t}$ is used since the gust downwash distribution over the vehicle is based on distance from the origin of the AAS system. Since t, true time must be zero at time of wave interception with the aircraft, shifted time is given by

$$\bar{t} = t + \tau$$

where t is true time and τ is the time for the wave to move from interception point to the origin of the AAS system, and is given by

$$\tau = \frac{\gamma_x X_I + \gamma_y Y_I + \gamma_z Z_I}{V_{ss}(1 + \gamma_x M)}$$

where

X_I, Y_I, Z_I = AAS coordinates of the point of shock interceiption

V_{ss} = speed of sound.

The inverse Fourier transform of the frequency response of a stable aircraft to gust forces resulting from the above downwash distributions may be shown to be the time history of the aircraft subjected to a unit impulsive gust. The Fourier transform of the gust time history convoluted in the frequency domain with the aircraft frequency response function and subsequently inverse transformed will be the time response of the vehicle to the actual gust time history. The Fourier transformation requires that gust function, G(t), be absolutely integrable; and such is the case. Examination of typical material velocity time histories shows that their Fourier transforms are effectively zero in the range of 40 to 60 Hz. This implies that the inverse Fourier procedure will predict the time history of the aircraft well if all roots of the aeroelastic system out to the maximum frequency necessary to transform the gust function are available in the aircraft frequency response function. The implication of this is that either the frequency domain aerodynamics must be known out to this frequency range or the modal set describing the aircraft vibration characteristics must be truncated at sufficiently low frequency such that no roots exist between the last known frequency response solution frequency and the frequency of zero moduli (ω_{MAX}).

The driving routine GUSTDR calls the time module for the specified maneuver, forming the symmetric and antisymmetric trimmed flight loads P_{STRIM} and P_{ATRIM} and then loops on specified orientations for the resulting load time histories. Subroutine GSTHST calculates the burst scaling factors, gets the overpressure ratio from PRESS and the gust velocity from TPEVAL and GUSHRØ as a function of time and range. Shock time of arrival is calculated in TAR. Range is updated each time step in routine FLTPOS assuming the mean flight path reasonably follows the trajectory dictated by the maneuver speci-

fication (climbing turn, pullup or level flight). Routines TPINT and INTRBL are used to include the gound reflected and incident shock waves. ROUTINES TPEVAL, GUSRHØ, TAR, PRESS, INTRPB and TPINT are taken from Reference 1. The EFAS burst coordinates at time of burst are given by

$$\begin{Bmatrix} X_B \\ Y_B \\ Z_B \end{Bmatrix} = -S_o \begin{bmatrix} \cos\theta_c & \left(\sin\Phi_B \quad \sin\theta_c\right) & \left(\cos\Phi_B \quad \sin\theta_c\right) \\ 0 & \cos\Phi_B & -\sin\Phi_B \\ -\sin\theta_c & \left(\sin\Phi_B \quad \cos\theta_c\right) & \left(\cos\Phi_B \quad \cos\theta_c\right) \end{bmatrix} \begin{Bmatrix} \gamma_x \\ \gamma_y \\ \gamma_z \end{Bmatrix} + \begin{Bmatrix} 0 \\ R_T \\ h_o \end{Bmatrix}$$

where

S_o is the slant range at time zero (intercept time)

θ_c is the climb angle

ϕ_B is the bank angle

γ_x, γ_y, γ_z are direction cosines of the burst orientation with respect to the AAS system

R_T and h_o are the turn radius and altitude at time zero.

The aircraft position in the EFAS at time t is given by

$$\begin{Bmatrix} X_E \\ Y_E \\ Z_E \end{Bmatrix} = \begin{Bmatrix} -R_T \sin Rt \\ R_T \cos Rt \\ h_o + (V\sin\theta_c)t \end{Bmatrix} \qquad \text{climbing turn}$$

where

h_o = flight altitude

$\Omega = g\dfrac{\tan\Phi_B}{V}$

$R_T = \dfrac{V}{\Omega}$

V = aircraft flight velocity (fps)

t = time (secs)

or

$$\begin{Bmatrix} X_E \\ Y_E \\ Z_E \end{Bmatrix} = \begin{Bmatrix} -R_p \sin \bar{Q}_t \\ 0 \\ h_o + R_p[1-\cos(\bar{Q}t)] \end{Bmatrix} \qquad \text{symmetric pullout}$$

where

$$\bar{Q} = \frac{(n-1)g}{V}$$

$$R_P = \frac{V^2}{(n-1)g}$$

$$n = \text{load factor}$$

or

$$\begin{Bmatrix} X_E \\ Y_E \\ Z_E \end{Bmatrix} = \begin{Bmatrix} -Vt \\ 0 \\ h_o \end{Bmatrix} \qquad \text{for level flight}$$

The slant range S at time t is given by

$$S(t) = \sqrt{(X_E - X_B)^2 + (Y_E - Y_B)^2 + (X_E - Z_B)^2}$$

The time intervals are taken as 0.05 seconds until the gust velocity goes negative, then at 0.50 second intervals till the gust velocity is less than 2 fps (time T_{MAXS}). An extrapolation is then made to find T_{MAXS}, the time at which the gust velocity has returned to zero.

Routine TIMHST takes the output time history of the gust velocity V_g and local density ρ and with routine TRFFT Fourier transforms the product into the frequency domain:

$$G(t) = \rho(t) \cdot V_g(t)/\rho_{ambient}$$

and
$$g(i\omega) = \int_{-\tau}^{T_{MAXS}} G(t)e^{-i\omega t}\,dt$$

It is convenient to use an analytic function for G(t) for which the exact Fourier transform is known. The approximation

$$G(t) = G_0\left(2e^{-\alpha(t+\tau)} - e^{-\beta(t+\tau)}\right)$$

where G_0 is the gust velocity at time $t = -\tau$, fits the G function very well for numerous time histories of gust velocity with respect to the moving airframe. This is generally the case when the vehicle is moving towards the burst. The Fourier transform of G(t) then is given by:

$$g(i\omega) = G_0 \left\{ \left[\left(\frac{2\alpha}{\alpha^2+\omega^2} - \frac{\beta}{\beta^2+\omega^2} \right) \cos\omega\tau + \omega \left(\frac{2}{\alpha^2+\omega^2} - \frac{1}{\beta^2+\omega^2} \right) \sin\omega\tau \right] \right.$$

$$\left. + i \left[\left(\frac{2\alpha}{\alpha^2+\omega^2} - \frac{\beta}{\beta^2+\omega^2} \right) \sin\omega\tau - \omega \left(\frac{2}{\alpha^2+\omega^2} - \frac{1}{\beta^2+\omega^2} \right) \cos\omega\tau \right] \right\}$$

Routine TRFFT checks the fit of the function G(t) in the region of time when the gust velocity is negative (which is the area of poorest fit) and if the fitting function predictions exceed five percent of the actual time histories the Fourier transform is taken as the sum of a series of impulses over the time history of the burst.

The gust and density function is then convoluted in the frequency domain with the symmetric (P_S) and antisymmetric (P_A) load frequency response to the unit gust:

$$P_{gS}(i\omega) = P_S(i\omega) \cdot g(i\omega)$$

$$P_{gA}(i\omega) = P_A(i\omega) \cdot g(i\omega)$$

to form the perturbation loads for the blast.

The time history of the perturbation loads are calculated in IFT:

$$\bar{P}_S(t) = -\frac{2}{\pi} \int_0^{\omega_{MAX}} \text{Imag } [P_{gS}(i\omega) \sin\omega t] d\omega$$

$$\bar{P}_A(t) = -\frac{2}{\pi} \int_0^{\omega_{MAX}} \text{Imag } [P_{gA}(i\omega) \sin\omega t] d\omega$$

A discussion of the method of Fourier transforms used herein may be found in References 7, 8 and 9.

Routine LOADCH forms the right side and left side time history loads generated from the half aircraft analysis:

$$\bar{P}_{RHS(t)} = P_{STRIM} + \bar{P}_{ATRIM} + \bar{P}_{S(t)} + \bar{P}_A(t)$$

$$\bar{P}_{LHS(t)} = P_{STRIM} - P_{ATRIM} + \bar{P}_S(t) - \bar{P}_A(t)$$

Maximum positive and negative loads are saved and compared to allowable positive and negative loads. If a stress matrix has been defined in the limit loads module, the stress time histories are found and, if so flagged, the maximum allowable gust velocity established on the basis of input allowable stresses. The maximum allowable gust velocity for the burst conditions are estimated from

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7. Wylie, C.R. Jr., *Advanced Engineering Mathematics*, McGraw-Hill Book Co., Inc., New York, 1951.

8. Solodovnikov, V. V., *Introduction to the Statistical Dynamics of Automated Control Systems*, Dover Publications, Inc., New York, 1960.

9. Hurty, W.C. and Rubinstein, M. F., *Dynamics of Structures*, Prentice-Hall, Inc., New Jersey, 1964

$$V_{g_{MAX}}(t = +0) = \frac{\bar{P}_{MAX}(t) \cdot V_g(t = +0)}{P_{Allow}}$$

and the maximum allowable overpressure from:

$$\Delta P_m = P_o \left\{ \left(\frac{21}{25}\right) \left(\frac{V_{gMAX}}{V_{ss}}\right)^2 + \sqrt{\left(\frac{21}{25}\right)^2 \left(\frac{V_{gMAX}}{V_{ss}}\right)^4 + \left(\frac{49}{25}\right)\left(\frac{V_{gMAX}}{V_{ss}}\right)^2} \right\}$$

where V_{ss} is the ambient speed of sound (FPS) and p_o is the ambient pressure (psi).

A revised slant range is calculated by routine RANGE, which is an inversion of routine PRESS. If iteration for range has been specified, the time history load calculation process is repeated until convergence on an allowable gust velocity. At the conclusion of a response solution, the distance from burst to intercept (in the EFAS) is displayed.

Figure 20 details the major routines in this module.

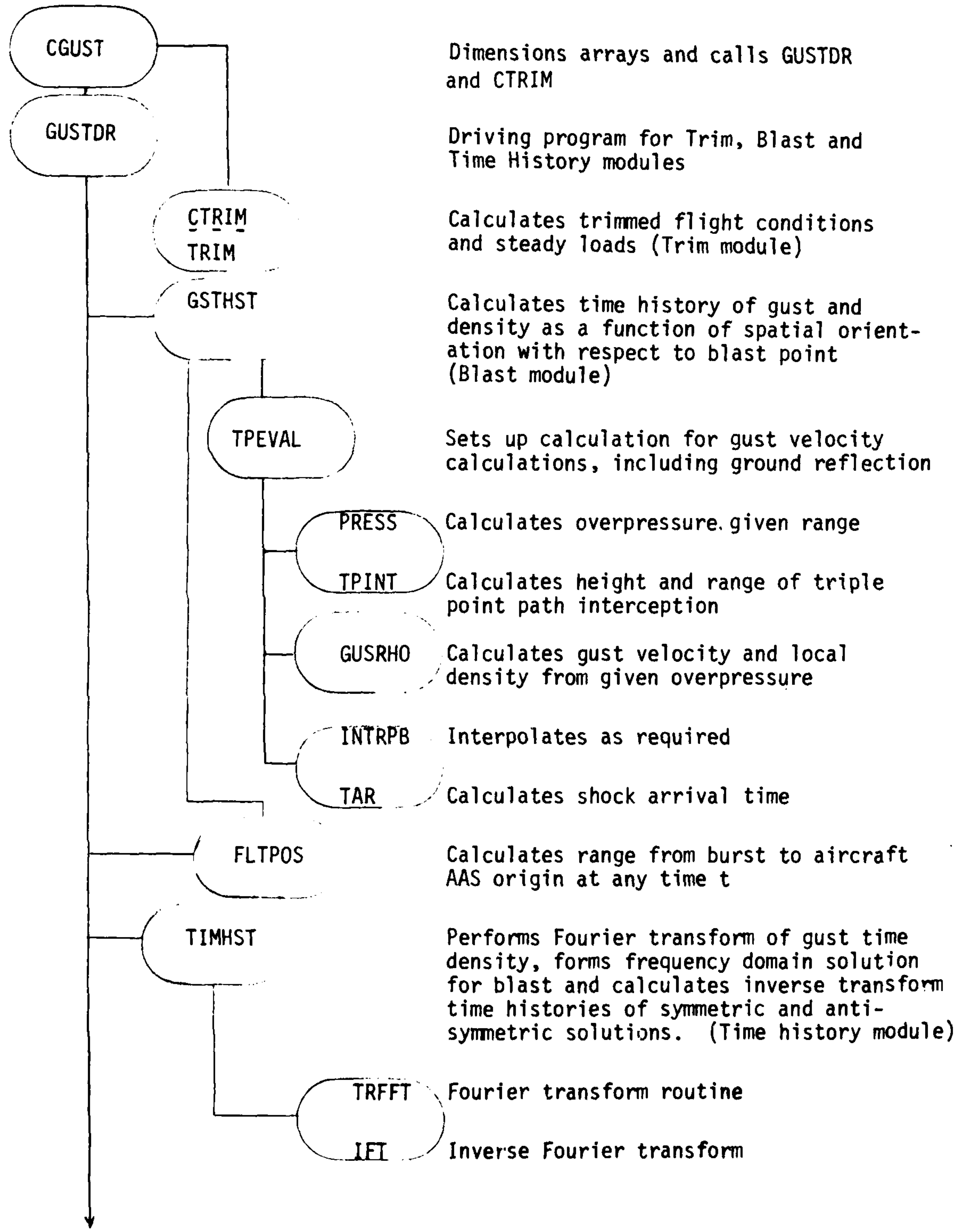

Figure 20. Blast and Time Response Module Routines

AD-A106 480 DOUGLAS AIRCRAFT CO LONG BEACH CA F/G 18/3

NUCLEAR BLAST RESPONSE COMPUTER PROGRAM. VOLUME I. PROGRAM DESC--ETC(U)

AUG 81 J A MCGREW, J P GIESING, T P KALMAN DNA001-75-C-0216

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LOADCH	Calculates left and right side perturbation loads as a function of specific orientation and sums in trim loads. Maximum and minimum loads are found and maximum overpressure for allowables calculated for next iteration, if any.
STRSCH	Calculates left and right side total stresses versus time.
RANGE	Calculates new allowable range for aircraft for specified overpressure and gust velocity.
FLTPOS	Finds distance from aircraft to burst at burst time

Figure 20 (contd). Blast and Time Response Module Routines

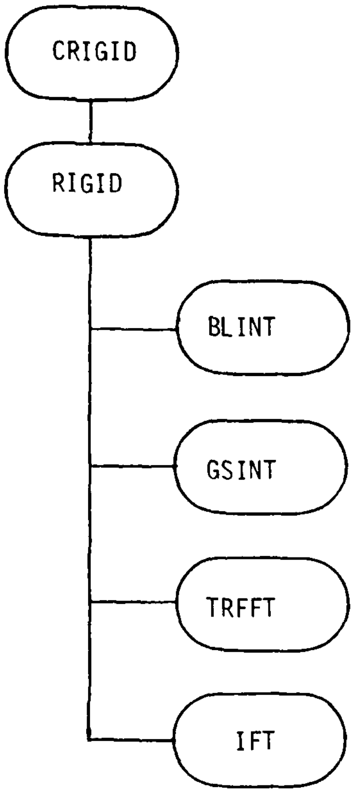
10. RIGID MODULE

The RIGID module has been added to permit correlation studies with experimental measurements of the blast loading of (effectively) rigid models. The experimental data on time histories of the moving reference point overpressure, density, and material velocity are input by the user and are utilized in place of the present internal calculations. The correlation pressure points are also specified by the user in terms of the locations of the aerodynamic boxes and slender body elements so that the pressure time histories for a steady angle of attack of the rigid vehicle can be determined.

The module first calculates the trim forces for the specified aerodynamic points by multiplying the forces from the AERO file by the dynamic pressure and the input values of generalized coordinates for any modes input to the AERO module. Next, the module performs a Fourier transform on the product of the input material velocity and density in order to put it in the frequency domain. After multiplying the result by the dynamic pressure and the gust forces from the AERO file, an inverse Fourier transform is performed to obtain the forces in the time domain. Adding these to the trim forces and dividing by box areas or body lengths leads to the desired pressures and running loads.

The output from this module is then the time histories of the pressures and running loads at the specified aerodynamic boxes and slender body elements. These may be compared to corresponding experimental results.

Figure 21 details the major routines in this module.



Dimensions arrays and calls RIGID

Calculates rigid loads

Calculates blast intercept

Interpolates gust forces from 'hard' point gust forces

Fourier transform routine

Inverse Fourier transform routine

Figure 21. Rigid Module Routines

11. MERGE MODULE

The MERG module has been added to permit the merging onto one file, the aerodynamic matrices for different reduced frequencies from two separate files. This module adds a capability that will save computing time in that a set of aerodynamic matrices for a new set of reduced frequencies can be obtained without rerunning any reduced frequencies that have already been previously obtained. This feature also saves computing when an AERO job runs out of time before computing all of the reduced frequencies requested. The user simply runs the AERO module for the frequencies not completed and merges with the previous file to obtain the complete set of aerodynamic matrices.

Onlv two files can be input for each run, but the output file can always be input to a subsequent merge run. The filenames of the input files are TAPE 17 and TAPE 18, and the file name of the output file is TAPE 19.

SECTION IV

PROGRAM INPUT

1. GENERAL DESCRIPTION OF INPUT DATA

The program input is divided into two (2) card decks called the Fixed Data Deck and the Run Data Deck respectively. The Fixed Data Deck is divided into four (4) major groups, according to the program module which uses the data, and contains all of the information which define the aircraft geometry, mass, mode shapes, frequencies, loads, etc. The Run Data Deck contains the information necessary to define the conditions describing the specific run; for example, the blast orientations to be considered and the associated trial ranges.

Each input card consists of either all integer numbers or all real numbers input in fields of 12 columns. Integer numbers are input right justified in the field; that is, the number is punched in the card so that it ends in the right-most column of the field. Real numbers are generally left-justified, which means the number is punched in the card so that it starts in the left-most column of the field. In the input descriptions that follow, the ending card column for integer numbers or the beginning card column for real numbers are indicated above the dashed lines and the input variables are indicated below the dashed line. Each item number begins on a new card.

Units of data describing geometry must be consistent and are expected in inches, though an input parameter SIZFCT is provided in the Run Data Deck to adjust for geometric data in units other

than inches. Units for the modal deflections are expected to be inches for linear deflections and radians for angular deflections. These linear or angular deflections are given for a unit modal amplitude. Jig mode input for calculating the basic lift and moment forces on the undeformed vehicle must be in the same units used for the geometry. Modes which describe the aerodynamic and inertial deflections in terms of rotations, such as rigid body pitch or control surface rotation modes, should be for one radian of rotation. An input parameter, RBRADF, is provided in the trim module input in the event some other rotational base value has been used. All such rotation modes must have the same reference rotational value.

All other unit requirements are as described in the detailed input data section.

2. FILE CONTROL STATEMENTS

All input and/or output data files used by VIBRA-6 are sequential files and can be stored on tape or disk directly at the time of creation using standard CDC control statements. The control statements for saving a file are the REQUEST statement for saving on tape and the CATALOG statement for saving on disk. The control statements for using a previously saved file are the REQUEST statement for a file saved on tape and the ATTACH statement for a file saved on disk. Files may be copied from tape to disk or disk to tape by the use of the COPYBF control statement without affecting the operation of the program. For the proper coding of control statements, the appropriate operating system manual should be consulted.

The following correspondence must be maintained between the data files, the Fortran unit designator, and the CDC filename.

Data File	Fortran Unit	CDC Filename
Run Data	5	TAPE5
Fixed Data	31	TAPE31
Aerodynamics	19	TAPE19
Unit Loads	34	TAPE34
Frequency Response	35	TAPE35
Unit Gust Loads	36	TAPE36

3. FIXED DATA DECK INPUT DESCRIPTION

The four major groups in the Fixed Data Deck are the sectional input data, the aerodynamic module input, the inertial module input, and the load module input. Each group is described in more detail preceeding the specific input descriptions that follow. If a given module is not to be executed in a run, the input data for that module does not need to be removed from the Fixed Data Deck. The program can find the data necessary to run any specific module via the data designator card which is the first card in each major group. The Fixed Data Deck is input using fortran unit 31 (TAPE31).

a. Sectional Input Data (SECT)

The input data for this module consist of flags for dimensioning and module control, locations of and deflections at the inertial nodal points, and modal frequencies and structural damping. This data is optional, but if it is input, it must be the first data in the Fixed Data Deck. Either the SECT or the IMOD data must be input and the program will use the first one that appears in the Fixed Data Deck.

ITEM NO. 1   Data designator card

```
cc       1         2         3         4         6
1________3_________5_________7_________9_________1_________
SECT
```

Variable	Description
SECT	=SECT, designates that the data following are the inertial module input data

ITEM NO. 2   Dimensioning data

```
cc        1          2          3          4          6          7
1_________2__________4__________6__________8__________0__________2
         NMS        NDOF       NSYM       NASYM      NENGS     KPRLDS
```

Variable	Description
NMS	number of 'right hand side' mass points, including centerline masses
NDOF	number of degrees of freedom per mass station
NSYM	number of symmetric modes
NASYM	number of antisymmetric modes
NENGS	number of engines on right hand side and centerline
KPRLDS	=1, print unit load matrices generated (if any) =0, do not print

ITEM NO. 3 Mass station locations. (Repeated for all mass stations, I=1,NMS)

cc 1	1 3	2 5	3 7	4 9	6 1
ELXIO	ELYIO	ELZIO			

Variable	Description
ELXIO	XAAS coordinate of mass, in.
ELYIO	YAAS coordinate of mass, in.
ELZIO	ZAAS coordinate of mass, in.

ITEM NO. 4 Inertial modal frequencies, FREQ, and mode shapes PHIX, PHIY, and PHIZ. (Repeated for all modes, N=1,NCMOD, where NCMOD=NSYM+NASYM)

cc 1	1 3	2 5	3 7	4 9	6 1
FREQ	FREQ	FREQ	FREQ	FREQ	FREQ

Variable	Description
FREQ	modal frequency, Hz

ITEM NO. 5 Modeshapes (Repeated for all mass stations, I=1 to NMS and all modes, N=1 to NSYM+NASYM)

FIRST CARD

cc 1	1 3	2 5	3 7	4 9	6 1
F	L	H	THETA	ALPHA	PSI

Variable	Description
F	linear deflection in the x-direction
L	linear deflection in the y-direction
H	linear deflection in the z-direction
THETA	rotational deflection about the x-axis
ALPHA	rotational deflection about the y-axis
PSI	rotational deflection about the z-axis

SECOND CARD (Input only if NDOF=7 or 8)

```
cc      1           2           3           4           6
1       3           5           7           9           1
BETA    DELTA
```

Variable	Description
BETA	rotational deflection about the primary control surface hinge-line
DELTA	rotational deflection about the secondary control surface hinge-line

ITEM NO. 6 Mass property table (Repeated for all mass stations, I=1,NMS). Note that this is not the mass matrix that is used by the program, but a table of mass properties that is used to form the mass matrix.

FIRST CARD

```
cc      1           2           3           4           6
1       3           5           7           9           1
M       MDELX       MDELY       MDELZ
```

Variable	Description
M	mass
MDELX	mass unbalance, x-direction
MDELY	mass unbalance, y-direction
MDELZ	mass unbalance, z-direction

SECOND CARD

```
cc      1           2           3           4           6
1       3           5           7           9           1
IXX     IYY         IZZ         IXY         IYZ         IZX
```

IXX	moment of inertia about x-axis
IYY	moment of inertia about y-axis
IZZ	moment of inertia about z-axis
IXY	product of inertia about x- & y-axis
IYZ	product of inertia about y- & z-axis
IZX	product of inertia about z- & x-axis

THIRD CARD (Input only if NDOF=7 or 8)

cc	1	2	3	4	6
1	3	5	7	9	1
SHB	PAB	IBB	PTB	SFB	PPB

Variable	Description
SHB	mass unbalance for primary control surface
PAB	product of inertia for primary control surface
IBB	moment of inertia for primary control surface
PTB	product of inertia relating theta and beta
SFB	mass unbalance relating f and beta
PPB	product of inertia relating psi and beta

FOURTH CARD (Input only if NDOF=8)

cc	1	2	3	4	6
1	3	5	7	9	1
SHD	PAD	PBD	IDD		

Variable	Description
SHD	mass unbalance for secondary control surface
PAD	product of inertia for secondary control surface relating alpha and delta
PBD	product of inertia for secondary control surface relating beta and delta
IDD	moment of inertia for secondary control surface

FIFTH CARD (Input only if NDOF=8)

cc	1	2	3	4	6
1	3	5	7	9	1
PTD	SFD	PPD			

Variable	Description
PTD	product of inertia for secondary control surface relating theta and delta
SFD	mass unbalance for secondary control surface relating f and delta
PPD	product of inertia for secondary control surface relating psi and delta

ITEM NO. 7 Modal definitions, AMODNO.

FIRST CARD

```
cc        1          2          3          4          6          7
1_________2__________4__________6__________8__________0__________2
       MODE1      MODE2      MODE3      MODE4      MODE5
```

Variable	Description
MODE1	mode number of rigid body plunge mode
MODE2	mode number of rigid body pitch mode
MODE3	mode number of rigid body fore and aft mode
MODE4	mode number of first symmetric elastic mode
MODE5	mode number of last symmetric elastic mode

SECOND CARD

```
cc        1          2          3          4          6          7
1_________2__________4__________6__________8__________0__________2
       MODE6      MODE7      MODE8      MODE9
```

Variable	Description
MODE6	mode number of pitch trim mode
MODE7	mode number of symmetric jig mode
MODE8	mode number of first symmetric mode to be deleted in this analysis
MODE9	mode number of last symmetric mode to be deleted in this analysis

THIRD CARD

```
cc        1          2          3          4          6
1_________2__________4__________6__________8__________0___________
      MODE11     MODE12     MODE13     MODE14     MODE15
```

Variable	Description
MODE11	mode number of rigid body roll mode
MODE12	mode number of rigid body yaw mode
MODE13	mode number of rigid body lateral mode
MODE14	mode number of first antisymmetric elastic mode
MODE15	mode number of last antisymmetric elastic mode

FOURTH CARD

```
cc          1            2            3            4            6
1___________2____________4____________6____________8____________0___________
        MODE16       MODE17       MODE18       MODE19       MODE20
```

Variable	Description
MODE16	mode number of roll trim mode
MODE17	mode number of yaw trim mode
MODE18	mode number of antisymmetric jig mode
MODE19	mode number of first antisymmetric mode to be deleted in this analysis
MODE20	mode number of last antisymmetric mode to be deleted in this analysis

Note: Trim modes may also be defined as elastic modes. For example, the yaw trim mode (usually rudder rotation) might also be used in the yaw damper system and hence be defined as an elastic mode, a trim mode and in the ACS definition.

ITEM NO. 8 Modal structural damping, CPXDPG. (Repeated until the damping for all modes has been read in for N=1,NOMOD)

```
cc            1            2            3            4            6
1_____________3____________5____________7____________9____________1__________
CPXDPG    CPXDPG       CPXDPG       CPXDPG       CPXDPG       CPXDPG
```

Variable	Description
CPXDPG	modal structural damping

Note: The structural damping should be input zero in all modes except the elastic modes.

b. Aerodynamic Module Input Data (AERO)

The input data for this module consist of the following five groups of data: general data, panel data, body data, modal spline interpolation data, and gust data. The general data, panel data, and modal spline interpolation data must always be input, but the body data and gust data are optional as specified by flags in the general data.

The general data consist of flags for dimensioning and program control, locations of and deflections at the aerodynamic nodal points, and constants. The panel and body data consist of the input necessary to define completely each panel and body. The modal spline interpolation data consist of the data to relate the aerodynamic nodal points to the panel and body data. The gust data allow nonstandard blast orientations to be input for the gust calculations.

Units of data describing geometry must be consistent with the units for the other major groups.

GROUP NO. 1 General Data

ITEM NO. 1 Data designator card

```
cc        1         2         3         4         6
1_________3_________5_________7_________9_________1_________
AERO
```

Variable	Description
AERO	=AERO, designates that the data following are the aerodynamic module input data

ITEM NO. 2 Dimensioning data

```
cc         1          2          3          4          6          7
1__________2__________4__________6__________8__________0__________2
       NODES       NSYM      NASYM      MFIX1      MFIX2
```

Variable	Description
NODES	number of aerodynamic nodal points
NSYM	number of symmetric modes
NASYM	number of antisymmetric modes
MFIX1	mode number of first mode to monitor
MFIX2	mode number of second mode to monitor

Note: Gusts can not be monitored.

ITEM NO. 3 Dimensioning data

```
cc         1          2          3          4          6          7
1__________2__________4__________6__________8__________0__________2
          NP     MSTRIP      NSMAX      NCMAX     NBOXES
```

Variable	Description
NP	Total number of panels on all lifting surfaces
MSTRIP	Total number of strips for all panels
NSMAX	Maximum number of strips per panel
NCMAX	Maximum number of chordwise boxes per panel
NBOXES	Total number of lifting surface boxes

ITEM NO. 4 Dimensioning data

```
cc         1          2          3          4          6          7
1__________2__________4__________6__________8__________0__________2
          NB       MSBE        MBE
```

Variable	Description
NB	Total number of bodies
MSBE	Total number of slender body elements for all bodies
MBE	Total number of interference body elements for all bodies

ITEM NO. 5 Coordinates of aerodynamic nodal points. Item numbers 5 and 6 are omitted if SECT data has been input since these data will be obtained by the program from the SECT data.
(Repeated for all aerodynamic points, I=1,NODES)

cc 1	1 3	2 5	3 7	4 9	6 1
ELXIA	ELYIA	ELZIA			

Variable	Description
ELXIA	XAAS coordinate of aerodynamic nodal point
ELYIA	YAAS coordinate of aerodynamic nodal point
ELZIA	ZAAS coordinate of aerodynamic nodal point

ITEM NO. 6 Modeshapes (Repeated first for all aerodynamic points I=1,NODES, and then for all modes J=1,NSYM+NASYM)

cc 1	1 3	2 5	3 7	4 9	6 1
PHINA	PHIZA	PHIYA			

Variable	Description
PHINA	Mode shape in normal direction at panel aerodynamic nodal point
PHIZA	Mode shape in z-direction at body aerodynamic nodal point
PHIYA	Mode shape in y-direction at body aerodynamic nodal point

ITEM NO. 7

```
cc      1       2       3       4       6       7
1-------2-------4-------6-------8-------0-------2
     IPR1    IPF2    IPF3    NGUST
```

Variable	Description
IPF1	Print flag for the normalwash and gust boundary conditions =1, print all boundary conditions =0, no print
IPF2	Print flag for point forces that are saved on the AERO file =1, print forces =0, no print
IPF3	Print flag for pressures, body loadings, and downwash factors =1, print pressures only =2, print pressures and body loadings only =3, print pressures, body loadings, and the downwash factor matrix, DT and DTA =0, do not print any of the above
NGUST	Gust direction cosine override flag =0, use standard direction cosine matrix for 13 gust conditions =n, override some (or all) elements of the direction cosine matrix for the gust boundary conditions. n=number of total gust conditions (max=20) See input under Group No. 5

ITEM NO. 8

```
cc      1       2       3       4       6       7
1-------2-------4-------6-------8-------0-------2
      NKD     NKP     MK1     MK2
```

Variable	Description
NKD	Number of reduced frequencies for doublet lattice calculations
NKP	Number of reduced frequencies for piston theory calculations
MK1	Sequence number of first box on first panel representing a body surface, whenever this body is at zero incidence; otherwise MK1=0
MK2	Sequence number of last box on last panel representing a body surface, whenever this body is at zero incidence; otherwise MK2=0

Note: Panels on body surfaces need not be input last. Maximum number of reduced frequencies (NKD+NKP)=100

ITEM NO. 9

cc 1	1 3	2 5	3 7	4 9	6 1
FMACH	REFA	REFS	REFC	XM	SCALER

Variable	Description
FMACH	Mach number, usual definition
REFA	Reference area, usually total area of both wings
REFS	Reference semispan
REFC	Reference chord, usually average chord of wing
XM	Moment axis
SCALER	Nondimensional image radius

ITEM NO. 10 (Repeated until all FREQ(I) are input for I=1,NK, where NK = NKD+NKP)

cc 1	1 3	2 5	3 7	4 9	6 1
FREQ	FREQ	FREQ	FREQ	FREQ	FREQ

Variable	Description
FREQ	Reduced frequency

GROUP NO. 2 Panel data (Items 1 thru 5 repeated for all panels, N=1,NP)

ITEM NO. 1

```
cc          1          2          3          4          6
1__________3__________5__________7__________9__________1_________
X1          X2         X3         X4
```

Variable	Description
X1	inboard leading edge x-coordinate
X2	inboard trailing edge x-coordinate
X3	outboard leading edge x-coordinate
X4	outboard trailing edge x-coordinate

ITEM NO. 2

```
cc          1          2          3          4          6
1__________3__________5__________7__________9__________1_________
Y1          Y2         Z1         Z2
```

Variable	Description
Y1	inboard edge y-coordinate
Y2	outboard edge y-coordinate
Z1	inboard edge z-coordinate
Z2	outboard edge z-coordinate

ITEM NO. 3

```
cc         1          2          3          4          6          7
1__________2__________4__________6__________8__________0__________2
          NC         NS        IGRUP
```

Variable	Description
NC	Number of chordwise boxes for panel
NS	Number of spanwise strips for panel
IGRUP	Group number of panel. Usually, panels that are butted up trailing edge to leading edge are members of the same group, and then the monitored span loads will be calculated for the 'combined strips' of such panels. For panels in the same IGRUP, strips with the same y-coordinate (for dihedral of 45 degrees or less) or the same z-coordinate (for dihedral of greater than 45 degrees) will be added into one combined strip for the span load calculation only.

ITEM NO. 4 (Repeated until all TH(I) are input for I=1,NC+1)

```
cc      1       2       3       4       6
1_______3_______5_______7_______9_______1_______
TH      TH      TH      TH      TH      TH
```

Variable	Description
TH	Fractional chordwise divisions for panel. Usually varies from 0.0 at the leading edge to 1.0 at the trailing edge

ITEM NO. 5 (Repeated until all TAU(I) are input for I=1,NS+1)

```
cc      1       2       3       4       6
1_______3_______5_______7_______9_______1_______
TAU     TAU     TAU     TAU     TAU     TAU
```

Variable	Description
TAU	Fractional spanwise divisions for panel. Usually varies from 0.0 at the inboard edge to 1.0 at the outboard edge

GROUP NO. 3 Body data (Items 1 thru 7 repeated for all bodies, N=1,NB. If NB=0, skip to Group No. 4)

ITEM NO. 1

```
cc        1         2         3         4         6
1_________3_________5_________7_________9_________1_________
ZC        YC        A0        AR
```

Variable	Description
ZC	z-coordinate of body axis
YC	y-coordinate of body axis
A0	average characteristic semi-width of interference body
AR	cross-sectional aspect ratio of body (height/width)

ITEM NO. 2

```
cc       1         2         3         4         6         7
1________2_________4_________6_________8_________0_________2
      NBE      NSBE       NRI       NRS       NT1
```

Variable	Description
NBE	number of interference body elements
NSBE	number of slender body elements
NRI	interference 'radius' flag =1, RI array is input below =0, RI(I) = A0, for all I=1,NBE+1
NRS	slender body 'radius' flag =1, RS array is input below =0, RS(I) = A0, for all I=1,NSBE+1
NT1	number of elements in the TH1 array below (max=20)

ITEM NO. 3 (Repeated until all XII(I) are input for I=1,NBE+1)

```
cc        1         2         3         4         6
1_________3_________5_________7_________9_________1_________
XII       XII       XII       XII       XII       XII
```

Variable	Description
XII	x-coordinates of interference body element endpoints

ITEM NO. 4 (Repeated until all RI(I) are input for I=1,NBE+1. Omit if NRI=0)

```
cc          1          2          3          4          6
1           3          5          7          9          1
----------------------------------------------------------------
RI          RI         RI         RI         RI         RI
```

Variable	Description
RI	semi-widths or radii of interference body element endpoints

ITEM NO. 5 (Repeated until all TH1(I) are input for I=1,NT1)

```
cc          1          2          3          4          6
1           3          5          7          9          1
----------------------------------------------------------------
TH1         TH1        TH1        TH1        TH1        TH1
```

Variable	Description
TH1	angular orientation of the points on interference body surfaces, degrees

Note: These points must not lie near any of the lifting-surface-body intersections. Also for elliptic bodies TH1 is not the angular orientation of a point on the body surface but an angular orientation parameter. The actual location of the point is:

Z=AR*A*SIN(TH1), Y=A*COS(TH1)

ITEM NO. 6 (Repeated until all XIS(I) are input for I=1,NSBE+1)

```
cc          1          2          3          4          6
1           3          5          7          9          1
----------------------------------------------------------------
XIS         XIS        XIS        XIS        XIS        XIS
```

Variable	Description
XIS	x-coordinates of slender body element endpoints

ITEM NO. 7 (Repeated until all RS(I) are input for I=1,NSBE+1. Omit if NRS=0)

```
cc          1          2          3          4          6
1           3          5          7          9          1
----------------------------------------------------------------
RS          RS         RS         RS         RS         RS
```

Variable	Description
RS	semi-widths or radii of slender body endpoints

GROUP NO. 4 Modal Spline Interpolation Data

ITEM NO. 1

cc	1 2	2 4	3 6	4 8	6 0	7 2
1	NSB	NSP	NMAX	KPRINT		

Variable	Description
NSB	Number of superbodies
NSP	Number of superpanels (=0, if SECT input)
NMAX	Maximum number of aerodynamic nodal points in any one of the superbodies/superpanels
KPRINT	Print flag =1, print H and DHDX matrices =0, do not print

ITEM NO. 2 Item numbers 2 thru 4 are repeated first for all NSB superbodies, then for all NSP superpanels.

cc	1 2	2 4	3 6	4 8	6 0	7 2
1	IF1	NXQ	NSUP	IXCON	NACELL	

Variable	Description
IF1	Flag to select either surface spline or linear spline calculations (Not used with SECT input data) =0, surface spline (used for superpanels) =1, linear spline (used for superbodies)
NXQ	Number of aerodynamic nodal points in the current superbody/superpanel
NSUP	Number of bodies/panels in the current superbody/superpanel
IXCON	Flag to indicate x or y=constant for superbody (not used for superpanel) =1, x=constant =0, y=constant (usual case)
NACELL	flag to specify a body as a nacelle (Used only with SECT input data) =1, body is a nacelle =0, body is not a nacelle

ITEM NO. 3 (Repeated until all INSUP(I) are input for I=1,NSUP)

cc	1 2	2 4	3 6	4 8	6 0	7 2
1	INSUP	INSUP	INSUP	INSUP	INSUP	INSUP

Variable	Description
INSUP	Array of body numbers/panel numbers in the current superbody/superpanel

ITEM NO. 4 (Repeated until all NODE(I) are input for I=1,NXQ)

cc	1 2	2 4	3 6	4 8	6 0	7 2
1	NODE	NODE	NODE	NODE	NODE	NODE

Variable	Description
NODE	Array of aerodynamic nodal point numbers in the current superbody/superpanel

ITEM NO. 5 Item numbers 5 thru 12 are input only if SECT data has been input.

cc	1 2	2 4	3 6	4 8	6 0	7 2
1	NSUPTO	MAXSEC	MAXPR			

Variable	Description
NSUPTO	total number of superpanels
MAXSEC	maximum number of sections in any one superpanel
MAXPR	maximum value of IPAIR (Item 11) for any section

ITEM NO. 6 Item numbers 6 thru 13 are repeated for all NSUPTO superpanels.

```
cc       1          2          3          4          6          7
1________2__________4__________6__________8__________0__________2
      NSEC       NODES      NEAASS      NODASS
```

Variable	Description
NSEC	number of sections in current superpanel (see text of Volume II for definition of a section)
NODES	number of nodes in current superpanel. NODES=0 for control surface without nodes on its hingeline
NEAASS	Identification number of the superpanel which contains the nodes which are associated with the current control surface superpanel.
NODASS	The number of nodes lying on the associated super-panel that are to be used for the current control surface superpanel. NODASS must be less than or equal to the maximum number of nodes on the associated superpanel.

Note: NEAASS and NODASS pertain to the case where a superpanel is a control surface and does not have its own nodes. If such is not the case set them to zero.

ITEM NO. 7 Degree of freedom flags for current superpanel

```
cc       1          2          3          4          6          7
1________2__________4__________6__________8__________0__________2
         H          A          T          B          D
```

Variable	Description
H	=H, use the H degree of freedom for all specified nodes for current superpanel
A	=A, use the ALPHA degree of freedom
T	=T, use the THETA degree of freedom
B	=B, use the BETA degree of freedom
D	=D, use the DELTA degree of freedom

ITEM NO. 8   Elastic axis endpoint coordinates.

```
cc        1         2         3         4         6
1         3         5         7         9         1
XA        YA        ZA        XB        YB        ZB
```

Variable	Description
XA	XAAS coordinate of inboard end of elastic axis
YA	YAAS coordinate of inboard end of elastic axis
ZA	ZAAS coordinate of inboard end of elastic axis
XB	XAAS coordinate of outboard end of elastic axis
YB	YAAS coordinate of outboard end of elastic axis
ZB	ZAAS coordinate of outboard end of elastic axis

Note: Endpoint coordinates must not be the same as any nodal point coordinates. The elastic axis for a control surface superpanel is the hingeline of the control surface.

ITEM NO. 9   (Repeated until all NODE(I) are input for I=1,NODES. Omit if NODES=0)

```
cc        1         2         3         4         6         7
1         2         4         6         8         0         2
       NODE      NODE      NODE      NODE      NODE      NODE
```

Variable	Description
NODE	node numbers in the current superpanel

ITEM NO. 10   (Repeated until all NASS(I) are input for I=1,NODASS. Omit if NODASS=0)

```
cc        1         2         3         4         6         7
1         2         4         6         8         0         2
       NASS      NASS      NASS      NASS      NASS      NASS
```

Variable	Description
NASS	Identification numbers of nodes lying on an associated superpanel that are to be used on the current control surface superpanel which has no nodes of its own. NASS must be a subset of the nodes of the associated superpanel.

ITEM NO. 11 Item numbers 11 thru 13 are repeated for all NSEC sections for the current superpanel.

```
cc       1          2           3           4           6           7
1________2__________4___________6___________8___________0___________2
       IFP       IPAIR
```

Variable	Description
IFP	=1, section is cut by parallel lines =0, section is cut by radial lines
IPAIR	number of pairs of box numbers to be input in item 12

Note: The aerodynamic boxes lying in a section must be identified. These boxes can be identified by the first and last box numbers of a sequence of boxes. Since there may be more than one sequence of consecutive boxes there may be several pairs of first-last box number combinations.

ITEM NO. 12

```
cc          1          2           3           4           6
1___________3__________5___________7___________9___________1_________
XO          YO         ZO
```

Variable	Description
XO	XAAS coordinate of reference for section
YO	YAAS coordinate of reference for section
ZO	ZAAS coordinate of reference for section

ITEM NO. 13 (Repeated for all IPAIR pairs)

```
cc       1          2           3           4           6           7
1________2__________4___________6___________8___________0___________2
         I1         I2
```

Variable	Description
I1	box number of first box of group of boxes for the current section
I2	box number of last box of group of boxes for the current section

GROUP NO. 5 Gust Data (Input only if NGUST≠0)

ITEM NO. 1 (Repeated for each gust condition to be added or overridden)

```
cc         1 1        2         3
1          2 4        5         7
          NN XCOS     YCOS      ZCOS
```

Variable	Description
NN	A number from 1 to NGUST indicating the gust condition to be input. If NN is less than 14, the standard gust corresponding to NN will be overridden with the following input. If NN is greater or equal to 14, the gust whose direction cosines are given below will be added to the existing 13 standard gust orientations. (the maximum number of standard plus additional gusts is 20) NN=-1 indicates end of optional gust input.
XCOS	cos(alpha), direction cosine from the x-axis to blast center
YCOS	cos(beta), direction cosine from the y-axis to blast center
ZCOS	cos(gamma), direction cosine from the z-axis to blast center

c. Inertial Module Input Data (IMOD)

The input data for this module consists of flags for dimensioning and module control, locations of and deflections at the inertial nodal points, and modal frequencies and structural damping.

<u>ITEM NO. 1</u> Data designator card

```
cc        1         2         3         4         6
1_________3_________5_________7_________9_________1_________
IMOD
```

<u>Variable</u>	<u>Description</u>
IMOD	=IMOD, designates that the data following are the inertial module input data

<u>ITEM NO. 2</u> Dimensioning data

```
cc       1         2         3         4         6         7
1________2_________4_________6_________8_________0_________2
       NMS      NENGS     KPFLDS
```

<u>Variable</u>	<u>Description</u>
NMS	number of 'right hand side' mass points, including centerline masses
NENGS	number of engines on right hand side and centerline
KPFLDS	=1, print unit load matrices generated (if any) =0, do not print

<u>ITEM NO. 3</u> Mass and location data. (Repeated for all masses N=1,NMS)

```
cc        1         2         3         4         6
1_________3_________5_________7_________9_________1_________
EM        ELXIO     ELYIO     ELZIO
```

<u>Variable</u>	<u>Description</u>
EM	mass, lb. sec. sec/in
ELXIO	XAAS coordinate of mass, in.
ELYIO	YAAS coordinate of mass, in.
ELZIO	ZAAS coordinate of mass, in.

ITEM NO. 4 Inertial modal frequencies, FREQ, and mode shapes PHIX, PHIY, and PHIZ. (Repeated for all modes, N=1,NOMOD, where NOMOD=NSYM+NASYM. NSYM and NASYM are input in the AERO data)

FIRST CARD

cc	1	2	3	4	6
1	3	5	7	9	1
FREQ					

Variable	Description
FREQ	modal frequency, Hz

NEXT CARD (Repeated for all mass points, I=1,NMS. Order must correspond to that of ITEM NO. 3)

cc	1	2	3	4	6
1	3	5	7	9	1
PHIX	PHIY	PHIZ			

Variable	Description
PHIX	mode shape in x direction at mass station
PHIY	mode shape in y direction at mass station
PHIZ	mode shape in z direction at mass station

ITEM NO. 5 Modal definitions, AMODNO.

FIRST CARD

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
MODE1	MODE2	MODE3	MODE4	MODE5		

Variable	Description
MODE1	mode number of rigid body plunge mode
MODE2	mode number of rigid body pitch mode
MODE3	mode number of rigid body fore and aft mode
MODE4	mode number of first symmetric elastic mode
MODE5	mode number of last symmetric elastic mode

SECOND CARD

```
cc        1         2         3         4         6         7
1_________2_________4_________6_________8_________0_________2
     MODE6     MODE7     MODE8     MODE9
```

Variable	Description
MODE6	mode number of pitch trim mode
MODE7	mode number of symmetric jig mode
MODE8	mode number of first symmetric mode to be deleted in this analysis
MODE9	mode number of last symmetric mode to be deleted in this analysis

THIRD CARD

```
cc        1         2         3         4         6
1_________2_________4_________6_________8_________0___________
     MODE11    MODE12    MODE13    MODE14    MODE15
```

Variable	Description
MODE11	mode number of rigid body roll mode
MODE12	mode number of rigid body yaw mode
MODE13	mode number of rigid body lateral mode
MODE14	mode number of first antisymmetric elastic mode
MODE15	mode number of last antisymmetric elastic mode

FOURTH CARD

```
cc        1         2         3         4         6
1_________2_________4_________6_________8_________0___________
     MODE16    MODE17    MODE18    MODE19    MODE20
```

Variable	Description
MODE16	mode number of roll trim mode
MODE17	mode number of yaw trim mode
MODE18	mode number of antisymmetric jig mode
MODE19	mode number of first antisymmetric mode to be deleted in this analysis
MODE20	mode number of last antisymmetric mode to be deleted in this analysis

Note: Trim modes may also be defined as elastic modes. For example, the yaw trim mode (usually rudder rotation) might also be used in the yaw damper system and hence be defined as an elastic mode, a trim mode and in the ACS definition.

ITEM NO. 6   Modal structural damping, CPXDPG.
(Repeated until the damping for all modes has been read in for N=1,NOMOD)

cc 1	1 3	2 5	3 7	4 9	6 1
CPXDPG	CPXDPG	CPXDPG	CPXDPG	CPXDPG	CPXDPG

Variable	Description
CPXDPG	modal structural damping

Note: The structural damping should be input zero in all modes except the elastic modes.

d. Unit Load Module Input Data (LOAD)

The input data for this module consists of flags for dimensioning and module control and all the data necessary to define the desired loads.

ITEM NO. 1 Data designator card

```
cc       1        2        3        4        6
1        3        5        7        9        1
LOAD
```

Variable	Description
LOAD	=LOAD, designates that the data following are the unit load module input data

ITEM NO. 2 Dimensioning data

```
cc         1          2          3          4          6          7
1          2          4          6          8          0          2
     NBEAMS     NINTLD     NSTRSS     NMGRP     NABGRP     NSBGRP
```

Variable	Description
NBEAMS	number of beams for integrated loads
NINTLD	number of integrated loads
NSTRSS	number of stresses
NMGRP	number of groups of masses associated with beams
NABGRP	number of groups of aerodynamic boxes associated with beams
NSBGRP	number of groups of aerodynamic slender body elements associated with beams

ITEM NO. 3 Beam geometry, BEAMGM
(Repeated for all beams, N=1, NBEAMS)

FIRST CARD

```
cc       1        2        3        4        6
1        3        5        7        9        1
XI       YI       ZI
```

Variable	Description
XI	XAAS coordinate of inner end of beam, in.
YI	YAAS coordinate of inner end of beam, in.
ZI	ZAAS coordinate of inner end of beam, in.

SECOND CARD

```
cc          1          2          3          4          6
1_________3__________5__________7__________9__________1__________
XO          YO         ZO         CODE
```

Variable	Description
XO	XAAS coordinate of outer end of beam, in.
YO	YAAS coordinate of outer end of beam, in.
ZO	ZAAS coordinate of outer end of beam, in.
CODE	Code defining the component to which the beam belongs =1.0, wing or horizontal tail =2.0, fuselage =3.0, vertical stabilizer =4.0, wing pod =5.0, fuselage pod =6.0, vertical stabilizer pod

ITEM NO. 4 Required integrated loads, STALDS
(Repeated for all loads, N=1,NINTLD)

FIRST CARD

```
cc          1          2          3          4          6
1_________3__________5__________7__________9__________1__________
BEAMNO      CODEL      CODEC
```

Variable	Description
BEAMNO	beam number of the beam with which the integrated load is associated.
CODEL	load code =1.0, integrated load is moment Mx =2.0, integrated load is moment My =3.0, integrated load is moment Mz =4.0, integrated load is shear Pz =5.0, integrated load is shear Py =6.0, integrated load is shear Px
CODEC	code defining the component to which the load belongs =1.0, wing or horizontal tail =2.0, fuselage =3.0, vertical stabilizer =4.0, wing pod =5.0, fuselage pod =6.0, vertical stabilizer pod

SECOND CARD

cc	1	2	3	4	6
1	3	5	7	9	1
XL	YL	ZL	PMAX	PMIN	

Variable	Description
XL	XAAS coordinate of location of integrated load, in.
YL	YAAS coordinate of location of integrated load, in.
ZL	ZAAS coordinate of location of integrated load, in.
PMAX	maximum allowable positive load
PMIN	maximum allowable negative load (a negative number)

ITEM NO. 5 Matrix defining local stresses in terms of the integrated loads, STRESS. (Repeated until all of the STRESS matrix has been read in by rows. Omit if NSTRSS=0)

cc	1	2	3	4	6
1	3	5	7	9	1
STRESS	STRESS	STRESS	STRESS	STRESS	STRESS

Variable	Description
STRESS	element of STRESS matrix relating local stresses to the integrated loads

ITEM NO. 6 Definition of groups of masses associated with beams, NFNLMB. (Repeated for N=1,NMGRP)

cc	1	2	3	4	6
1	3	5	7	9	1
NFM	NLM	BEAMNO			

Variable	Description
NFM	number of first mass in group
NLM	number of last mass in group
BEAMNO	beam number to which group is associated

ITEM NO. 7 Direction cosine matrix relating mass point deflection to the AAS coordinate deflections (x,y,z, ordered). (Repeated until three rows for each mass group have been read in, I=1,3, N=1,NMGRP)

cc	1	2	3	4	6
1	3	5	7	9	1
TLAMV1	TLAMV2	TLAMV3			

Variable	Description
TLAMV1	first element of the ith row of TLAMV matrix
TLAMV2	second element of the ith row of TLAMV matrix
TLAMV3	third element of the ith row of TLAMV matrix

ITEM NO. 8 Definition of groups of aero boxes associated with beams, NFNLAB. (Repeated for N=1,NABGRP)

cc	1	2	3	4	6
1	3	5	7	9	1
NFAB	NLAB	BEAMNO			

Variable	Description
NFAB	number of first aero box in group
NLAB	number of last aero box in group
BEAMNO	beam number with which group is associated

ITEM NO. 9 Definition of groups of slender body elements associated with beams, NFNLSB. (Repeated for N=1,NSBGRP)

cc	1	2	3	4	6
1	3	5	7	9	1
NFSB	NLSB	BEAMNO			

Variable	Description
NFSB	number of first slender body element in group
NLSB	number of last slender body element in group
BEAMNO	beam number with which group is associated

ITEM NO. 10 Definition of engine mass points, NENGM.
(Repeated for N=1,NENGS. Omit if NENGS=0)

```
cc          1           2           3           4           6
1_________3___________5___________7___________9___________1__________
ENGM1     ENGM2
```

Variable	Description
ENGM1	number of first mass defining the engine
ENGM2	number of second mass defining the engine

Note: Force due to thrust acts at ENGM1 along a vector pointed from ENGM2 to ENGM1

4. RUN DATA DECK INPUT DESCRIPTION

The Run Data Deck must always be available and is the standard fortran input unit 5 (TAPE5).

GROUP NO. 1 Identification of configuration, print control, control of execution, and case constants

ITEM NO. 1 Identification of configuration and print control

```
cc         1          2          3          4          6          7
1__________2__________4__________6__________8__________0__________2
       IDENT     KPRCXQ     KPRCHQ     KPRCXL     KPRCHL
```

Variable	Description
IDENT	identification number of configuration
KPRCXQ	=n, print generalized response for orientation n
KPRCHQ	=n, print check matrices in frequency response module for orientation n
KPRCXL	=n, print integrated load modulii due to unit gust for orientation n
KPRCHL	=n, print matrix data for unit gust calculations for orientation n

ITEM NO. 2   Module execution control card

cc	1-4	9-12	17-20	25-28	33-36	41-44
	OPCD	OPCD	OPCD	OPCD	OPCD	OPCD

Variable	Description
OPCD	defines modules to be executed =AERO, execute aerodynamic module =UNIT, execute unit loads module =ACSM, execute active control system module =FRSP, execute frequency response module =GUST, execute unit gust loads module =BLST, execute trim loads, blast, and time history modules =RIGD, execute rigid loads module =MERG, execute aero file merge module
Note:	The user must specify which modules are to be executed in any given pass through the program. If a module is specified to be executed and sufficient data is not available (from any required source) the program will halt with an explanatory statement. The active control system module need only be executed when running with FRSP and/or GUST specified, but the control system definition must be the same if these two modules are not run in the same pass.

ITEM NO. 3   Case constants (If MERG or AERO has been specified on the module control card, omit this item)

cc	1	13	25	37	49	61
	ALT	VKEAS	SIZFCT	PLQ	PLL	

Variable	Description
ALT	altitude, ft
VKEAS	velocity, equivalent airspeed in knots
SIZFCT	size factor defining the units of the input geometry data relative to inches. default=1.0
PLQ	=n, plot generalized response for nth orientation =0.0, do not plot
PLL	=n, plot nth load due to unit gust for all orientations =0.0, do not plot

GROUP NO. 2 Active control system. (If ACSM has not been specified on the module control card, omit this group)

Input modes must contain a mode which describes the motion of the surface driving the system as commanded by the active system. The input modal amplitude of this mode must be consistent with the commanded/sensed movement as defined by the transfer function input data. The scalar multiplier may be used for this purpose. Note that several transfer functions may be used to drive any single mode, but any single transfer function may drive only one mode. Thus if two surfaces are being used and driven by the same mathematical transfer function and two separate modes are used to define these control surface motions, the transfer function must be entered twice and defined by two different transfer function numbers.

ITEM NO. 1 Control and dimensioning data

cc	1	2	3	4	6	7
1	2	4	6	8	0	2
	NTFS	NTFA	MXBLK	MXOBLK		

Variable	Description
NTFS	number of symmetric transfer functions
NTFA	number of antisymmetric transfer functions
MXBLK	maximum number of blocks input in any single transfer function with items 3 or 5
MXOBLK	maximum order of any block polynomial in input transfer function blocks with items 3 or 5

ITEM NO. 2 Data describing kinematics of active control system for symmetric control, TMSS. (Repeated for I=1,NTFS. If NTFS=0, skip to item no. 4)

cc 1	1 3	2 5	3 7	4 9	6 1
TMSS1	TMSS2	TMSS3	TMSS4		

Variable	Description
TMSS1	mass point number of sensed mass point
TMSS2	degree of freedom number of sensed degree of freedom =1.0,PHIX; =2.0,PHIY; =3.0,PHIZ; or if SECT input: =1.0,F; =2.0,L; =3.0,H; =4.0,THETA; =5.0,ALPHA; =6.0,PSI; =7.0,BETA; =8.0,DELTA
TMSS3	scalar multiplier on sensed degree of freedom motion
TMSS4	mode number of the driving mode (should be a control surface mode).

ITEM NO. 3 Data defining elements of symmetric transfer function.

cc 1	1 3	2 5	3 7	4 9	6 1
NTF	NBLK	NORD	AN	AD	TLAST

Variable	Description
NTF	transfer function number =-1.0, no more input data for this item
NBLK	block number of these elements
NORD	power of LaPlace operator (s), associated with these elements
AN	numerator coefficient
AD	denominator coefficient
TLAST	last transfer function associated with this data =0.0, entry is for transfer function NTF only ≠0.0, entry is for transfer function NTF thru TLAST

ITEM NO. 4 Data describing kinematics of active control system for antisymmetric control, TMSA. (Repeated for I=1,NTFA. If NTFA=0, skip to group 3)

cc 1	1 3	2 5	3 7	4 9	6 1
TMSA1	TMSA2	TMSA3	TMSA4		

Variable	Description
TMSA1	mass point number of sensed mass point
TMSA2	degree of freedom number of sensed degree of freedom =1.0,PHIX; =2.0,PHIY; =3.0,PHIZ; or if SECT input: =1.0,F; =2.0,L; =3.0,H; =4.0,THETA; =5.0,ALPHA; =6.0,PSI; =7.0,BETA; =8.0,DELTA
TMSA3	scalar multiplier on sensed degree of freedom motion
TMSA4	mode number of the driving mode

ITEM NO. 5 Data defining elements of antisymmetric transfer function.

cc 1	1 3	2 5	3 7	4 9	6 1
NTF	NBLK	NORD	AN	AD	TLAST

Variable	Description
NTF	transfer function number =-1.0, no more input data for this item
NBLK	block number of these elements
NORD	power of LaPlace operator (s), associated with these elements
AN	numerator coefficient
AD	denominator coefficient
TLAST	last transfer function associated with these data =0.0, entry is for transfer function NTF only ≠0.0, entry is for transfer function NTF thru TLAST

Note: Inputing AN, AD and ALAST, blank fields are not the same as 0.0; therefore 0.0's must be input explicitly.

GROUP NO. 3 Frequency response. (If FRSP has not been specified on the module control card, omit this group)

ITEM NO. 1 Dimensioning and control data

```
cc        1         2         3         4         6         7
1_________2_________4_________6_________8_________0_________2
      NFRGR
```

Variable	Description
NFRGF	number of frequency groups to be input in item no. 2

ITEM NO. 2 Frequency groups (Repeated for N=1,NFRGF)

```
cc        1         2         3         4         6
1_________3_________5_________7_________9_________1__________
F1        F2        DF
```

Variable	Description
F1	starting frequency (hz) for this group
F2	ending frequency (hz) for this group
DF	incremental frequency for this group

Note: input frequencies must be entered in an ascending order and groups must not overlap, nor should any frequency be repeated.

GROUP NO. 4 Unit gust loads. (If GUST has not been specified on the module control card, omit this group)

ITEM NO. 1 Dimensioning and control data

```
cc        1         2         3         4         6         7
1_________2_________4_________6_________8_________0_________2
      NACC
```

Variable	Description
NACC	number of mass points for acceleration calculations

ITEM NO. 2 Acceleration indexes (Repeated until all mass point numbers have been input for N=1,NACC. Omit if NACC=0)

```
cc        1         2         3         4         6         7
1_________2_________4_________6_________8_________0_________2
     MASSNO       IDOF    MASSNO       IDOF    MASSNO      IDOF
```

Variable	Description
MASSNO	mass point number for which acceleration is desired
IDOF	degree of freedom for which acceleration is desired =1, x-direction =2, y-direction =3, z-direction

GROUP NO. 5 Trim and blast data. (If BLST has not been specified on the module control card, omit this group)

ITEM NO. 1 Trim constants

cc 1	1 3	2 5	3 7	4 9	6 1
AN	KMAN	ZDOT	KPRTRM	RBRADF	

Variable	Description
AN	load factor
KMAN	manuever constant =0.0, no manuever =1.0, symmetric pull-up or push-over =2.0, turn
ZDOT	climb rate, fps (input only if KMAN=2.0)
KPRTRM	=1.0, print all matrices in trim solution =0.0, do not print
RBRADF	scale factor for rotation modes input at other than for one radian rotation, = 1 rad/value used in radians (default=1.0)

ITEM NO. 2 Time history constant and blast characteristics

cc 1	1 3	2 5	3 7	4 9	6 1
TIMEMX	DELT	EFF	HGRD	KPRTMH	KPLTMH

Variable	Description
TIMEMX	maximum time for time history, sec
DELT	delta time for time histories
EFF	weapon yield, KT
HGRD	height of ground above sea level, ft
KPRTMH	=1.0, print total load time histories =0.0, do not print
KPLTMH	=1.0, plot load time histories for RHS of aircraft =2.0, plot load time histories for LHS of aircraft =3.0, plot both LHS and RHS =0.0, do not plot

Note: DELT is increased by a factor of 5 after 0.25 seconds of response and again by a factor of 2 after 1.0 seconds.

ITEM NO. 3 Control flags

```
cc          1              2              3              4              6              7
1___________2______________4______________6______________8______________0______________2
       NORMAX          KGRD           KLPT          KLOAD         NCRITS         KPRBLS
```

Variable	Description
NORMAX	maximum number of orientations to be considered
KGRD	control constant for ground reflection =0, no ground reflection =1, include ground reflection
KLPT	=1, iteration for critical range is desired =0, no iteration
KLOAD	=1, new maximum allowable loads input in item no. 7
NCRITS	=1, maximum stresses input in item no. 8
KPRBLS	=1, print blast matrices for checkout =0, do not print

ITEM NO. 4 Thrust input data, THRUST. (Repeat until all thrust (I) have been input for I=1,NENGS. If NENGS=0, omit this item)

```
cc           1              2              3              4              6
1____________3______________5______________7______________9______________1____________
THRUST       THRUST         THRUST         THRUST         THRUST         THRUST
```

Variable	Description
THRUST	engine thrust, lb.

ITEM NO. 5 Orientation numbers, NORS. (Repeat until all NORS (I) have been input for I=1, NORMAX)

```
cc          1              2              3              4              6              7
1___________2______________4______________6______________8______________0______________2
          NOR            NOR            NOR            NOR            NOR            NOR
```

Variable	Description
NOR	orientation number of blast for desired solution

Note: NORMAX and NOR must be consistent with the set of orientations established during execution of the FRSP module and available on the AERO file.

ITEM NO. 6 Range estimates, REST. (repeat until all REST(I) have been input for I=1,NORMAX)

cc	1	2	3	4	6
1	3	5	7	9	1
REST	REST	REST	REST	REST	REST

Variable	Description
REST	estimated range at shock arrival time, ft

ITEM NO. 7 Maximum allowable loads, STALDS. (Repeat for N=1,NINTLD. If KLOAD=0, omit this item)

cc	1	2	3	4	6
1	3	5	7	9	1
PMAX	PMIN				

Variable	Description
PMAX	maximum allowable positive load
PMIN	maximum allowable negative load (a negative number)

ITEM NO. 8 Maximum allowable stresses. (Repeat for N=1, NINTLD. If NCRITS=0, omit this item)

cc	1	2	3	4	6
1	3	5	7	9	1
SMAX	SMIN				

Variable	Description
SMAX	maximum allowable positive stress
SMIN	maximum allowable negative stress (a negative number)

GROUP NO. 6 Rigid loads. (If RIGD has not been specified on the module control card, omit this group)

ITEM NO. 1 Dimensioning and control data

```
cc          1          2          3          4          6          7
1__________2__________4__________6__________8__________0__________2
      NTMGST       NBOX       NSBE        NOR      IPLOT      IPREQ
```

Variable	Description
NTMGST	number of input time points for gust
NBOX	number of aerodynamic boxes for which time histories of pressures are desired
NSBE	number of slender body elements for which time histories of pressures are desired
NOR	gust orientation requested
IPLOT	plot flag for Fourier transform of RHO*VG and pressures
IPREQ	print flag for checkout print

ITEM NO. 2 Time history constants

```
cc           1           2           3           4           6
1___________3___________5___________7___________9___________1__________
TIMEMX      DELT
```

Variable	Description
TIMEMX	maximum time for output time history, sec
DELT	delta time for output time histories, sec

Note: DELT is increased by a factor of 5 after 0.25 seconds of response and again by a factor of 2 after 1.0 seconds.

ITEM NO. 3 Number of frequency groups

```
cc          1          2          3          4          6          7
1__________2__________4__________6__________8__________0__________2
      NFRGR
```

Variable	Description
NFRGR	number of frequency groups to be input in item no. 4

ITEM NO. 4   Frequency groups (Repeated for N=1,NFRGR)

```
cc         1          2          3          4          6
1__________3__________5__________7__________9__________1__________
F1         F2         DF
```

Variable	Description
F1	starting frequency (hz) for this group
F2	ending frequency (hz) for this group
DF	incremental frequency for this group

Note: input frequencies must be entered in an ascending order and groups must not overlap, nor should any frequency be repeated.

ITEM NO. 5   Aerodynamic box numbers at which presssures are desired. (Repeat until all IBOXES(I) have been input for N=1,NBOX)

```
cc          1          2          3          4          6          7
1___________2__________4__________6__________8__________0__________2
         IBOX       IBOX       IBOX       IBOX       IBOX       IBOX
```

Variable	Description
IBOX	aerodynamic box number at which pressure is desired

ITEM NO. 6   Slender body element numbers at which pressures are desired. (Repeat until all ISBE(I) have been read in for N=1,NSBE)

```
cc          1          2          3          4          6          7
1___________2__________4__________6__________8__________0__________2
         ISBE       IDIR       ISBE       IDIR       ISBE       IDIR
```

Variable	Description
ISBE	slender body element number at which pressure is desired
IDIR	force direction: =1, z-direction; =2, y-direction

ITEM NO. 7 Input generalized coordinates. (Repeat until all Q(I) have been input for N=1,NOMOD)

cc 1	1 3	2 5	3 7	4 9	6 1
Q	Q	Q	Q	Q	Q

Variable	Description
Q	input generalized coordinate

ITEM NO. 8 Input time histories of overpressure, density, and material velocity. (Repeat until all time points have been input for N=1,NTMGST)

cc 1	1 3	2 5	3 7	4 9	6 1
TIME	DP	RHO	VG		

Variable	Description
TIME	time, seconds
DP	overpressure, psi
RHO	density, lb-sec**2/ft**4
VG	material velocity, ft/sec

GROUP NO. 7 Merge of aerodynamic files from TAPE17 and TAPE18 onto TAPE19. (If MERG has not been specified on the module control card, omit this group)

ITEM NO. 1 Number of input reduced frequencies

```
cc         1          2          3          4          6          7
1__________2__________4__________6__________8__________0__________2
        INK1       INK2
```

Variable	Description
INK1	number of frequencies from TAPE17 file to be merged
INK2	number of frequencies from TAPE18 file to be merged

ITEM NO. 2 Reduced frequencies from TAPE17 file. (Repeated until all RKIN1(I) have been input for I=1,INK1)

```
cc         1          2          3          4          6
1__________3__________5__________7__________9__________1__________
RKIN1      RKIN1      RKIN1      RKIN1      RKIN1      RKIN1
```

Variable	Description
RKIN1	value of reduced frequency from TAPE17 file for which aero is to be merged

ITEM NO. 3 Reduced frequencies from TAPE18 file. (Repeated until all RKIN2(I) have been input for I=1,INK2)

```
cc         1          2          3          4          6
1__________3__________5__________7__________9__________1__________
RKIN2      RKIN2      RKIN2      RKIN2      RKIN2      RKIN2
```

Variable	Description
RKIN2	value of reduced frequency from TAPE18 file for which aero is to be merged

5. DISCUSSION OF INPUT DATA

Fixed data deck input for the structural model is essentially the same as that given in Reference 1 with the exception of the aerodynamic model data and the unit load data. However, rigid body modes and trim must be input to both the aerodynamic module and the inertial module. Rigid body modes should consist of rigid body plunge, pitch, fore and aft, roll, yaw, and lateral translation. Trim modes describe surface motion necessary to trim the aircraft and consist of a mode each for pitch, roll, and yaw. These and the rigid body rotation modes should consist of the control point deflections for one radian of rotation. In the event that some other reference rotation is used, then a correction factor must be input to the trim module (RBRADF). Details of aerodynamic data preparation are given in Volume II of this report. The choice of reduced frequencies for the aerodynamics module must include k=0 and the second reduced frequency should be small (approximately 0.1). The maximum value should be high enough to extend the frequency somewhat beyond the highest natural free-free frequency of the elastic model. Reduced frequency spacing should be relatively uniform and consist of about 4 values for each 1.0 k used, though 3 will often suffice.

Unit load data required is explained in the unit load module description. Care should be taken with this data to insure that the beam segments used to define the load paths are contiguous or that all appropriate load stations (mass and aero) feed load to the appropriate beam segment.

Active system definition input data is discussed in that module.

The choice of frequencies for solution depends on the vehicle under analysis. Small increments of frequency should be used in the aircraft rigid body frequency range and near the elastic modal frequencies. Broader spacing may be used between separated modes. In the event a frequency is input which is beyond the maximum definable by the unsteady aerodynamic matrices available, the program will designate it as unusable. The maximum frequency available is given by

$$f = Vk/6.28b$$

where V is the true airspeed, k is the maximum reduced frequency available, and b is the reference semi-chord.

Run data are as described in that section, except that DELT should be small enough to give the response of the highest frequency mode, DELT greater than or equal 0.2f. The time of solution (TIMEMX) should be at least 5S/Vss where S is the maximum length of the vehicle (tip to tip or nose to tail) and Vss is the speed of sound at flight altitude.

SECTION V

PROGRAM OUTPUT

The program output is generally self-explanatory in that all output data are preceded by headings and variable definitions which are for the most part consistent with the data definitions found in the module description and input data sections of the report.

Input data from the Fixed and Run Data Decks for any given run are printed out for the purpose of checking input data.

Generated data files, output by the several modules, are described in Section VI.

The use of a generated data file is followed by a printout of the data file header which identifies the file and gives a brief summary of the data on the file. A rewind of any file initiates a message to that effect.

During the execution of any module, messages informing the user of the number of incremental words (in decimal) required for the module are printed.

Several auxiliary print flags are available for use throughout the program. These are intended primarily for checkout purposes. The data printed consist of either input data to one module from the generated file data of a preceding module or the matrix equations formed within the module in execution. The equations are described in the module description section of the report. The user should note that the use of these print flags will result in a large amount of print.

Output from the aerodynamic module is described in detail in Volume II.

The user should check the aerodynamic output at a reduced frequency of zero to insure that the generalized forces and moments due to rigid body pitch and yaw for one radian rotations are numerically identical to the gust forces for the vertical and lateral gust orientations respectively. Lack of agreement indicates an error in modal deflection inputs for the aero node points. The error will usually be in the sign of the input for a group of points.

Output from the inertial module consists of the mass and mass point geometry, the inertial mode shapes, the modal definition table, the structural damping coefficients and the generalized mass and stiffness.

Output from the unit loads module consists of a summary of all input data for the module. In addition, the sweep and dihedral for each local beam are printed and an array defining the beams loaded (by input number) by any load first entering each defined beam. The TLAMY matrices and TLAMM for each beam are displayed. The printout following consists of the AAS location of each load point, inertial and aero, by groups as defined in the input. If the print flag KPRLDS (Fixed Data Deck) has been input non-zero, the integrated loads due to each inertial and aero load point will be printed out along with the integrated loads due to unit modal amplitude for inertial motion and aero motion.

The active system module output consists of the input definition data, a summary of the values of all block polynomials used to define the system and the transfer function polynomial in powers of $i\omega$. The final transfer functions are also printed out for a frequency of one rad/sec for check purposes. The antisymmetric data follow the symmetric data.

The frequency response module printed output consists only of the gust orientation number, direction cosines, the flight condition, and the frequencies of solution. If the print flag KPRCXQ has been input for an orientation there will be printed the generalized response solution vector q for each frequency. If the print flag KPRCHQ is input, the file input generalized motion dependent aero matrices and the gust forces on all aerodynamic elements will be printed out. The aero force integration arrays will also be printed. In addition, for each frequency of solution, the interpolated generalized gust forces, motion dependent aero forces and the equations for the generalized response will be printed. If an active system has been defined, all incremental mass and aero matrices will also be printed. The symmetric cases print first, and are followed by the antisymmetric (if an antisymmetric solution is required for the particular orientation flagged for print).

The basic print output of the unit gust loads module consists only of a message of the number of orientations analyzed. If the plot flag PLQ has been specified nonzero, the generalized response for all modes for the gust orientation specified will be plotted. If the plot flag PLL is input, the integrated load so specified will be plotted versus frequency for all orientations. If the print flag KPRCXL is nonzero, there will be displayed the complex integrated loads per unit gust for the specified orientation and their moduli for all frequencies. Setting the flag KPRCXL greater than 100 will cause a print of the integrated load moduli for all orientations. The use of the flag KPRCHL will invoke a printout of all data used to generate the loads due to unit gust for the specified orientation. These data consist of the frequencies of solution, the

interpolation coefficients, the generalized response vectors for all frequencies, the integrated loads due to unit inertial modal amplitude and unit aero modal amplitude (PIQ, PAQS, PAQA) and finally the integrated loads from summation of all forces.

The output from the Trim, Blast and Time History Modules consists of a summary of input control data for these modules and a summary of the modal control data for the symmetric trim solution and flight condition data. The generalized coordinate solutions for the symmetric part of the solution are displayed and the symmetric trim parameters for the maneuver condition follow. If the maneuver specified requires an antisymmetric trim solution, similar data for the antisymmetric solutions are printed. These data are followed by a summary of symmetric (and antisymmetric, if present) trim loads at the specified integrated load stations.

In the event that the user has flagged the trim matrix print flag (KPRTRM) there will be displayed the aerodynamic and inertial matrices used in the trim solution and the matrix equations solved for the symmetric and antisymmetric trim solutions.

The amount of blast and time history output is controlled by the three print flags, KPRTMH, KPLTMH, and KPRBLS. The minimum print, which should be the case for range iteration runs, consists of a summary of blast conditions and the delta time of intercept with respect to the AAS origin (τ) of the blast wave with the first aerodynamic load producing element of the vehicle and its AAS coordinates. These are followed by the EFAS coordinates of the AAS origin at time of intercept, the EFAS coordinates of the burst, the time required for the blast wave to reach the vehicle and the estimated highest

frequency of the gust function. The output following consists of a summary of the maximum positive and negative loads experienced at all integrated load stations and the maximum allowables. If a stress matrix has been specified, similar data are displayed for the stresses.

The next printed output is a summary of the present blast conditions and the estimated allowable blast conditions which are based on the allowables for load or stress. The next output (for the current iteration) consists of an estimate of the EFAS location of the aircraft for the estimated slant range, based on the allowables, and the relative position of the aircraft with respect to the burst at time of burst and, if a converged solution has been achieved, a notation of same.

The final output for each orientation is a summary of the integrated load definitions.

If the user has flagged the blast plot flag, KPLTMH, there will be plotted the material velocity time history and the time history of all the integrated loads.

If the print flag KPRTMH has been input, complete load time histories, will be printed for all integrated loads. If the print flag KPRBLS has been input there will result a complete printout of the gust, density and range time history, the Fourier transform of the gust material velocity times density ratio and the symmetric (and antisymmetric if necessary for the blast condition) frequency response function which consists of the product of the frequency response of the aircraft to the unit gust with the above transform function. The complete symmetric time history perturbation (and antisymmetric if required) solution for all integrated loads will also be printed.

SECTION VI

PROGRAM OPERATION

VIBRA-6 has been coded to operate on a CDC 6600. The concept of dynamic core has been utilized throughout the program, thus removing any restriction on the problem size other than the maximum core available.

Dynamic core on the CDC is achieved by using blank COMMON for all dimensioned variables. Since blank COMMON is loaded in central memory following the last subroutine, the remainder of core is available for use as dynamically allocated core. An RFL control card specifying the total central memory (program + dynamic core) must be specified before execution because blank COMMON has been dimensioned so that it has a length of 2. Dimensioning data are available from input data, the length of each array is calculated, and the starting location in COMMON of that array is referenced to the first location of COMMON as a subscripted array. The array dimensioning for each of the main program modules is shown in Tables 4 through 13. The tables show the variable length of each array and the relative location of that array with respect to the other arrays. Figure 22 shows graphically the relationship between the primary program modules and the various dimension levels. The total amount of core required to run any specific module can be calculated by using Table 14.

The various COMMON blocks used throughout the program are described in detail in Tables 15 through 19. The tables are self-explanatory except for Table 19. The COMMON block DDTBLS is essentially 10 tables

of 20 words each, where the second subscript of DDTBL is used to specify a given table. The tables are used by the data file access subroutines to read and write the appropriate data from the generated data files. The organization of the data on the files is described in Tables 20 through 24.

The Fortran listing of all subroutines is given in Volume III of this report.

The program is modularized such that each module can be executed independently, thus an efficient overlay feature is used to reduce the amount of central memory necessary for any given run. This overlay is accomplished using the CDC SEGLOAD loader. The SEGLOAD directives required are listed in Table 25.

TABLE 4

CONTROL MODULE (DACGUST) ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
MDL1	1	L1	20	AMODNO	MODE LOCATION DEFINER
	2	L2	NOMOD	WR	MODAL FREQUENCIES (Hz)
	3	L3	NOMOD•NOMOD	EMBAR	GENERALIZED MASS
	4	L4	NOMOD	EMWR2	GENERALIZED STIFFNESS
MDL2	5	L41	NOMOD	CPXDPG	STRUCTURAL DAMPING
	6	L9	NMS•NOMOD	PHIX	X-INERTIAL MODE SHAPES
	7	L10	NMS•NOMOD	PHIY	Y-INERTIAL MODE SHAPES
	8	L11	NMS•NOMOD	PHIZ	Z-INERTIAL MODE SHAPES
	9	L51	NTFS•4	TMSS	ACTIVE SYSTEM KINEMATICS SYMMETRIC
	10	L52	NTFA•4	TMSA	ACTIVE SYSTEM KINEMATICS ANTISYMMETRIC
	11	L53	2•NTFS•MXORD	TFCS	TRANSFER FUNCTION POLYNOMIAL SYMMETRIC
	12	L54	2•NTFA•MXORD	TFCA	TRANSFER FUNCTION POLYNOMIAL ANTISYMMETRIC
	13	L55	NTFS•NSYM	PHISS	MODAL AMPLITUDES SENSED (SYM)
	14	L56	NTFA•NASYM	PHISA	MODAL AMPLITUDES SENSED (ASM)
MDL3	15	L5	IMS•NMS	EM	MASS PROPERTY TABLE
	16	L6	NMS	ELXIO	XAAS COORDINATES OF MASSES
	17	L7	NMS	ELYIO	YAAS COORDINATES OF MASSES
	18	L8	NMS	ELZIO	ZAAS COORDINATES OF MASSES
	19*	L12	NDF•NMS•NOMOD	EMPHI	MASS TIMES MODE SHAPES
	20*	L13	2•NENGS	NEMGM	ENGINE THRUST MASSES
	21**	L14	NDF•NDF•NMS	EMS	SECTIONAL MASS MATRIX
MDL4	15	L60	LENGTH1	D	SCRATCH
	15	L61	2•NTCTAP•NG	F	GUST FORCE
	16	L62	LENGTH2	WORK	SCRATCH
	16	L63	NTOTAP•NSYM	SPLS	AERO FORCE INTEGRATION MATRIX SYMMETRIC
	17	L64	NTOTAP•NASYM	SPLA	AERO FORCE INTEGRATION MATRIX ANTISYMMETRIC
	15	L70	6•NBCX	GEOMBX	BOX AAS COORDINATES
	16	L71	6•NSPETO	GEOMBD	BODY AAS COORDINATES

TABLE 4 (CONT'D)

CONTROL MODULE (DACGUST) ARRAY DIMENSIONING

DEFINITIONS:

NOMOD	TOTAL NUMBER OF MODES
NTFS	NUMBER OF SYMMETRIC TRANSFER FUNCTIONS
NTFA	NUMBER OF ANTISYMMETRIC TRANSFER FUNCTIONS
MXORD	(MXOBLK+1) (MXBLK)
MXOBLK	MAX. ORDER OF LARGEST TRANSFER FUNCTION BLOCK
MXBLK	NUMBER OF BLOCKS IN LARGEST TRANSFER FUNCTION
NSYM	NUMBER OF SYMMETRIC MODES
NASYM	NUMBER OF ANTISYMMETRIC MODES
IMS	NUMBER OF ITEMS IN MASS PROPERTY TABLE
NMS	NUMBER OF MASSES
NDF	NUMBER OF DEGREES OF FREEDOM PER MASS STATION
NENGS	NUMBER OF ENGINES
NBOX	NUMBER OF PANEL BOXES
NSBETO	NUMBER OF SLENDER BODY ELEMENTS
NTOTAP	NUMBER OF TOTAL AERO ELEMENTS (NBOX+2•NSBETO)
NG	NUMBER OF GUST ORIENTATIONS
LENGTH1	MAX(2•NSYM•NSYM, 2•NASYM•NASYM, NTOTAP•NSYM + NTOTAP•NASYM, 2•NTOTAP•NG)
LENGTH2	MAX(2•NBOX•NG, 2•NSBETO•NG, 2•NSYM•NSYM, 2•NASYM•NASYM)

* Dimensioned only for unit loads calculations

** Dimensioned only if sectional data are input

TABLE 5

AERODYNAMIC MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
ADL1	1	L1	NODES	ELXI	XAAS OF NODAL POINT
	2	L2	NODES	ELYI	YAAS OF NODAL POINT
	3	L3	NODES	ELZI	ZAAS OF NODAL POINT
	4	L4	NODES•MODES	PHINA	MODE SHAPE IN NORMAL DIR.
	5	L5	NODES•MODES	PHIZA	MODE SHAPE IN Z-DIRECTION
	6	L6	NODES•MODES	PHIYA	MODE SHAPE IN Y-DIRECTION
	7	L7	NP	NAS	NO. OF ASSOCIATED BODIES PER PANEL
	8	L8	NP•NB	NASB	ASSOCIATED BODY NUMBERS
	9	L9	NP	NBARAY	LAST BOX NO. OF EACH PANEL
	10	L10	NP	NCARAY	NO. OF CHORDWISE BOXES PER PANEL
	11	L11	NP	NSARAY	NO. OF SPANWISE BOXES PER PANEL
	12	L12	MSTRIP	ISSTR	SUPERSTRIP NO. OF EACH STRIP
	13	L13	MSTRIP	NSSTR	NO. OF STRIPS PER SUPERSTRIP
	14	L14	2•NB	IFLA	SEQUENCE NOS. OF IBE'S
	15	L15	2•NB	NBEA	IBE FLAGS
	16	L16	2•NB	NT12	NO. OF ANGULAR ORIENTATIONS PER BODY
	17	L17	NB	NSBEA	NO. OF SBE'S PER BODY
	18	L18	NB	YB	YAAS OF BODY CENTERLINES
	19	L19	NB	ZB	ZAAS OF BODY CENTERLINES
	20	L20	NB	ARB	BODY CROSS-SECTIONAL ASPECT RATIO
	21	L21	NB	AVR	BODY AVE. CHARACTERISTIC HALF-WIDTH
	22	L22	NB	XLE	XAAS OF LEADING EDGE OF BODY
	23	L23	NB	XTE	XAAS OF TRAILING EDGE OF BODY
	24	L24	MBE	RIA	RADII OF IBE'S
	25	L25	NB•10	TH1A	TH1 VALUES FOR ALL BODIES
	26	L27	MSBE	A0	SBE HALF-WIDTHS
	27	L28	MSBE	A0P	X-DERIVATIVE OF THE A0 VALUES
	28	L29	MSBE	XIS1	XAAS OF LEADING EDGE OF SBE'S
	29	L30	MSBE	XIS2	XAAS OF TRAILING EDGE OF SBE'S
	30	L31	MSTRIP+NB	CG	COSINE OF DIHEDRAL OF STRIPS
	31	L32	MSTRIP+NB	CS	CHORD LENGTH OF STRIPS
	32	L33	MSTRIP+NB	EE	HALF-WIDTH OF STRIPS
	33	L34	MSTRIP+NB	SG	SINE OF DIHEDRAL OF STRIPS
	34	L35	MSTRIP+NB	YS	YAAS OF STRIP CENTERLINE AND BODY ELEMENTS
	35	L36	MSTRIP+NB	ZS	ZAAS OF STRIP CENTERLINE AND BODY ELEMENTS

TABLE 5 (CONT'D)

AERODYNAMIC MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
ADL1 CONT.	36	L37	MSTRIP+NB	XIJ	XAAS OF LEADING EDGE OF STRIP CENTERLINES
	37	L38	MSTRIP+NB	YIN	YAAS OF INBOARD EDGE OF PANEL
	38	L39	MSTRIP+NB	ZIN	ZAAS OF INBOARD EDGE OF PANEL
	39	L40	MSTRIP+NB	COORD	SPANWISE COORDINATE OF STRIPS
	40	L41	NTOTAL	X	XAAS OF 3/4 CHORD OF BOXES AND MIDPOINT OF IBE'S
	41	L42	NTOTAL	XIC	XAAS OF 1/4 CHORD OF BOXES
	42	L43	NTOTAL	DELX	AVE. CHORD-LENGTHS OF BOXES AND IBE'S
	43	L44	NTOTAL	XLAM	TANGENT OF SWEEP OF 1/4 CHORD OF BOXES
	44	L45	NTOTAL	H	A COLUMN OF h MATRIX
	45	L46	NTOTAL	DHDX	A COLUMN OF dh/dx MATRIX
	46	L47	NTOTAL	DELA	AREAS OF BOXES
	46A	L47A	4•NTOTAL	XC	X-COORDINATES OF CORNERS OF LIFTING SURFACE BOXES
	47	L48	2•NTOTAL	DT	A ROW OF THE DT MATRIX
	48	L49	2•NTOTAL	DTA	A ROW OF THE DTA MATRIX
	49	L50	2•(MODES+NG)	RHS	TEMPORARY ARRAY
ADL2	50	L1	NCMAX	TH	PANEL CHORDWISE DIVISIONS
	51	L2	NSMAX	TAU	PANEL SPANWISE DIVISIONS
	52	L3	MBE	XII	XAAS OF IBE'S
	53	L4	MBE	RI	SEMI-WIDTHS OF IBE'S
	54	L5	MSBE	XIS	XAAS OF SBE'S
	55	L6	MSBE	RS	SEMI-WIDTHS OF SBE'S
	56	L7	NP	GMA	DIHEDRAL ANGLES OF PANELS
	57	L8	MSTRIP+NB	DYS	dy OF PANEL STRIPS
	58	L9	MSTRIP+NB	DZS	dz OF PANEL STRIPS
	59	L10	MSTRIP+NB	GMAR	DIHEDRAL ANGLE OF STRIPS
	60	L11	NTOTAL	XI1	XAAS OF INBOARD OF 1/4 CHORD LOCATION OF BOXES
	61	L12	NTOTAL	XI2	XAAS OF OUTBOARD OF 1/4 CHORD LOCATIONS OF BOXES
	62	L13	NTOTAL	ETA1	YAAS OF INBOARD OF BOXES AND CENTERLINE OF SBE'S
	63	L14	NTOTAL	ETA2	YAAS OF OUTBOARD OF BOXES AND CENTERLINE OF SBE'S
	64	L15	NTOTAL	ZETA1	ZAAS OF INBOARD OF BOXES AND CENTERLINE OF SBE'S
	65	L16	NTOTAL	ZETA2	ZAAS OF OUTBOARD OF BOXES AND CENTERLINE OF SBE'S
	66	L17	NTOTAL	ETA	YAAS OF CENTERLINE OF 3/4 CHORD LOCATION OF BOXES

TABLE 5 (CONT'D)

AERODYNAMIC MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
	67	L18	NTOTAL	ZETA	ZAAS OF CENTERLINE OF 3/4 CHORD LOCATION OF BOXES
	68	L19	MSBE	ETAS	YAAS OF LEADING EDGE OF SBE'S
	69	L20	MSBE	ZETAS	ZAAS OF LEADING EDGE OF SBE'S
ADL3	50	N1	NB	NBCUM	SBE INDEXES
	51	N2	MAX(NB,NP)	INSUP	BODY/PANEL NUMBERS
	52	N3	NODES	NODE	NODE NUMBERS IN SUPERBODY/ SUPERPANEL
	53	N4	NODES	XIQ	XAAS OF NODAL POINTS IN SUPERBODY/SUPERPANEL
	54	N5	NODES	ETAQ	YAAS OF NODAL POINTS IN SUPERBODY/SUPERPANEL
	55	N6	MSTRIP+NB	CSG	COSINES OF MODIFIED DIHEDRALS OF STRIPS
	56	N8	NTOTAL	X3L	SBE ENDPOINTS PER SUPERBODY
	57	N9	NTOTAL	YL	YAAS OF ELEMENTS IN SUPERBODY
	58	N10	NTOTAL	XP	XAAS OF BOXES IN SUPERPANEL
	59	N11	NTOTAL	YP	YAAS OF BOXES IN SUPERPANEL
	60	N12	NMAX•NMAX	XKD	WORK ARRAY FOR SPLINE
	61	N13	NMAX•NMAX	RHS	WORK ARRAY FOR SPLINE
ADL4	50	L1	NTMAX	COL	COLUMN OF h OR dh/dx
	51	L2	NTMAX•MODE	WORK	WORK ARRAY USED BY ORGN
ADL5	50	L1	2•NTOTAL	DT	ROW OF DT MATRIX
	50	L1	2•NTOTAL	DPZ	ROW OF DPZ MATRIX
	51	L2	2•NTOTAL	DPY	ROW OF DPY MATRIX
	52	L3	2•NTOTAL	DTA	ROW OF DTA MATRIX
	52	L3	2•NTOTAL	DPZA	ROW OF DPZA MATRIX
	53	L4	2•NTOTAL	DPYA	ROW OF DPYA MATRIX
	54	L5	112•NCMAX	WORK	WORK ARRAY FOR GEND
ADL6	50	L1	4•NTOT•MSBE+ 6•NTOT+ 10•MSBE	WORK	WORK AREA FOR SB
ADL7	50	L1	4•LENGTH	BFS	ROW OF SYMMETRIC BFS MATRIX
	51	L2	4•LENGTH	BFSA	ROW OF ANTI-SYMMETRIC BFS MATRIX
ADL8	50	L1	2•NTOTAL	W	COLUMN OF W MATRIX
	51	L2	2•NTOTAL	DW	COLUMN OF DW MATRIX
	52	L3	2•NTOTAL	COL	COLUMN FOR WORK STORAGE

TABLE 5 (CONT'D)

AERODYNAMIC MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
ADL9	50	L1	2•NTOTAL	WGS	COLUMN OF SYMMETRIC GUST BOUNDARY CONDITIONS
	51	L2	2•NTOTAL	WGA	COLUMN OF ANTI-SYMMETRIC GUST BOUNDARY CONDITIONS
ADL10	50	L1	2•NTOT•NMODE	WORK	WORK AREA FOR RHSIDE
ADL11	50	L1	2•MAX(3•NPM, NTOT•NMODE)	WORK	WORK AREA FOR SOLVIT
ADL12	50	L1	2•LENGTH	DT	WORK ARRAY FOR MATMUL
	51	L2	4•LENGTH•MSBE	WORK	WORK ARRAY FOR MATMUL
ADL13	50	L1	2•NTMAX	FORCE	POINT FORCE COLUMN
	51	L2	2•NTMAX	GF	GENERALIZED FORCE COLUMN
	52	L3	2•NTMAX	WORK	WORK ARRAY
ADL14	50	L1	2•NTOTAL	DCP	NODAL POINT PRESSURES
	51	L2	2•NRMAX	FZ	BODY ELEMENT z-FORCES
	52	L3	2•NRMAX	FY	BODY ELEMENT y-FORCES
	53	L4	2•NRMAX	CN	STRIP LIFT COEFFICIENTS
	54	L5	2•NRMAX	CM	STRIP MOMENT COEFFICIENTS
	55	L6	2•NRMAX	SPLD	SPAN LOADS
	56	L7	2•NB	CZB	BODY LIFT COEFFICIENT IN z-DIRECTION
	57	L8	2•NB	CYB	BODY LIFT COEFFICIENT IN y-DIRECTION
	58	L9	2•NB	CNB	BODY YAWING MOMENT COEFF.
	59	L10	2•NB	CMB	BODY PITCHING MOMENT COEFF.
	60	L11	MSTRIP	CPR	STRIP CENTER OF PRESSURE (REAL PART)
	61	L12	MSTRIP	CPI	STRIP CENTER OF PRESSURE (IMAGINARY PART)

TABLE 5 (CONT'D)

AERODYNAMIC MODULE ARRAY DIMENSIONING

DEFINITIONS:

SBE	SLENDER BODY ELEMENT
IBE	INTERFERENCE BODY ELEMENT
NODES	NUMBER OF AERODYNAMIC NODAL POINTS
MODES	NUMBER OF MODES = NSYM+NASYM
MODE	MAX(NSYM,NASYM)
NMODE	MODE+NG
NP	TOTAL NUMBER OF PANELS ON ALL LIFTING SURFACES
NB	TOTAL NUMBER OF BODIES
MSTRIP	TOTAL NUMBER OF STRIPS FOR ALL BODIES
MBE	TOTAL NUMBER OF IBE'S FOR ALL BODIES + 1
MSBE	TOTAL NUMBER OF SBE'S FOR ALL BODIES + 1
NTOTAL	TOTAL NUMBER OF LIFTING SURFACE BOXES + 2•MSBE
NTOT	TOTAL NUMBER OF LIFTING SURFACE BOXES + 2•MBE
NPM	NTOT+NMODE
NMAX	NTOTAL+3
NCMAX	MAX. NO. OF CHORDWISE BOXES PER PANEL
NSMAX	MAX. NO. OF STRIPS PER PANEL
NTMAX	MAX(NTOTAL,2•MBE)
LENGTH	NTOTAL + 2•MBE
NRMAX	MAX(MSTRIP,MSBE,MODES+2•NG)
NG	NUMBER OF GUST ORIENTATIONS

TABLE 6

UNIT LOADS MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
LDL1	1	L1	7•NBEAMS	BEAMGM	BEAM GEOMETRY
	2	L2	8•NINTLD	STALDS	INTEGRATED LOAD DEFINITION
	3	L3	3•NMGRP	NFNLNB	MASS SPARSING ARRAY
	4	L4	3•NAEGRP	NFNLAB	AERO BOX SPARSING ARRAY
	5	L5	3•NSBGRP	NFNLSB	SLENDER BODY SPARSING ARRAY
	6	L6	NSTRES•NINTLD	STRESS	STRESS/INTEGRATED LOAD
	7	L7	3•3•NMGRP	TLAMV	INERTIAL DOF DIR. COSINES
	8	L8	NBEAMS•NBEAMS	NBSEQ	BEAM LOAD PATHS
	9	L9	NBEAMS	NBCON	BEAM CONNECTIONS
	10	L91	NINTLD	SYMCOD	CENTERLINE LOAD MOD. (SYM)
	11	L92	NINTLD	ASMCOD	CENTERLINE LOAD MOD. (ASYM)
	12	L10	3•3•NBEAMS	TLAMM	BEAM/LOAD DIRECTION COSINES
	13	L11	4•NBEAMS	TLAMY	LOAD BEAM PLANE DEF.
LDL2	14	L12	LENGTH	PINTF	INTG'D LOADS DUE TO X MASS
	15	L13	LENGTH	PINTL	INTG'D LOADS DUE TO Y MASS
	16	L14	LENGTH	PINTH	INTG'D LOADS DUE TO Z MASS
	17*	L141	LENGTH	PINTT	INTG'D LOADS DUE TO THETA
	18*	L142	LENGTH	PINTA	INTG'D LOADS DUE TO ALPHA
	19*	L143	LENGTH	PINTP	INTG'D LOADS DUE TO PSI
	20	L15	NINTLD•NENGS	THRLOD	INTG'D LOADS DUE TO THRUST
	21	L16	NSYM•NENGS	THRGNF	GEN. FORCE DUE TO THRUST
	20	L15	NINTLD•NM	PIQ	INTG'D LOADS DUE TO GEN. RESP
LDL3	14	L12	LENGTHA	PINTP	INTG'D LOAD DUE TO AERO BOXES
	15	L13	LENGTHB	PINTZ	INTG'D LOAD DUE TO Z-SBE
	16	L14	LENGTHB	PINTY	INTG'D LOAD DUE TO Y-SBE
LDL4	17	L15	NBOXES	BBXIO	XAAS COORD. OF BOX FORCE LOAD
	18	L16	NBOXES	BBYIO	YAAS COORD. OF BOX FORCE LOAD
	19	L17	NBOXES	BBZIO	ZAAS COORD. OF BOX FORCE LOAD
	20	L18	NBOX	XI1	BOX INNER XAAS
	21	L19	NBOX	ETA1	BOX INNER YAAS
	22	L20	NBOX	ZETA1	BOX INNER ZAAS
	23	L21	NBOX	XI2	BOX OUTER XAAS
	24	L22	NBOX	ETA2	BOX OUTER YAAS
	25	L23	NBOX	ZETA2	BOX OUTER ZAAS
LDL5	17	L15	NAERSB	SBXIO	XAAS COORD OF SBE FORCE
	18	L16	NAERSB	SBYIO	YAAS COORD OF SBE FORCE
	19	L17	NAERSB	SBZIO	ZAAS COORD OF SBE FORCE
	20	L18	NSBETO	XIS1	SBE INNER XAAS
	21	L19	NSBETO	ETAS1	SBE INNER YAAS
	22	L20	NSBETO	ZETAS1	SBE INNER ZAAS
	23	L21	NSBETO	XIS2	SBE OUTER XAAS

TABLE 6 (CONT'D)

UNIT LOADS MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
	24	L22	NSBETO	ETAS2	SBE OUTER YAAS
	25	L23	NSBEFO	ZETAS2	SBE OUTET ZAAS
LDL6	17	L15	MXROW•MXCOL	FPH	BOX OR BODY FORCE DUE TO MODAL AMPLITUDE
	18	L16	NINTLD•MXCOL	PAQ	INTG'D LOAD DUE TO MODAL AMPLITUDE

DEFINITIONS:

SBE	SLENDER BODY ELEMENT
NBEAMS	NUMBER OF LOAD BEAMS
NINTLD	NUMBER OF INTEGRATED LOADS
NMGRP	NUMBER OF MASS GROUPS
NABGRP	NUMBER OF AERO BOX GROUPS
NSEGRP	NUMBER OF SLENDER BODY ELEMENT GROUPS
NSTRSS	NUMBER OF STRESSES
NMASS	MAX. NO. OF MASSES IN THE NMGRP MASS GROUPS
NBOXES	MAX. NO. OF AERO BOXES IN THE NABGRP BOX GROUP
NBOX	NUMBER OF AERO BOXES (TOTAL)
NAERSE	MAX. NO. SLENDER BODY ELEMENTS IN THE NSBGRP BODY GROUP
LENGTH	NINTLD•NMGRP•NMASS
LENGTHA	NINTLD•NABGRP•NBOXES
LENGTHB	NINTLD•NSEGRP•NAERSE
NSBETO	NUMBER OF SLENDER BODY ELEMENTS (TOTAL)
NENGS	NUMBER OF ENGINES
NSYM	NUMBER OF SYMMETRIC MODES
NASYM	NUMBER OF ANTISYMMETRIC MODES
NM	TOTAL NUMBER OF MODES (NSYM+NASYM)
MXROW	MAX(NBOX,NSBETO)
MXCOL	2•MAX(NSYM,NASYM)
*	Dimensioned only if sectional data are input

TABLE 7

ACTIVE SYSTEM MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
CDL1	1	L1	NTFM*MXORD	ANUM	TEMPORARY ARRAYS FOR
	2	L2	NTFM*MXORD	ADEN	FORMING TRANSFER
	3	L3	2*MXORD	ATEN	FUNCTION POLYNOMIALS
	4	L4	2*MXORD	ATED	TFCS AND TFCA
	5	L5	MXORD	ANUMT	
	6	L6	MXORD	ADENT	

DEFINITIONS:

NTFM	MAX. NO. TRANSFER FUNCTIONS (NTFS OR NTFA)
MXBLK	NO. BLOCKS IN LARGEST TRANSFER FUNCTION
MXOBLK	MAX ORDER OF LARGEST FUNCTION BLOCK
MXORD	MXBLK*(MXOBLK+1)

TABLE 8

FREQUENCY RESPONSE MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
FDL1	1	L12	2•NMMX•NMMX	D	GEN. FORCE DUE TO MOTION
	2	L13	2•NMMX	F	GEN. FORCE DUE TO GUST
	3	L14	NVBW	OMEGA	FREQUENCY (RAD/SEC)
	4	L15	2•NM	Q	GEN. RESPONSE
	5	L18	2•NMMX•NMMX	TFM	SCRATCH FOR ACTIVE SYSTEM
	6	L19	NTOTAP•NSYM	SPLS	AERO FORCE INTEGR MAT (SYM)
	7	L20	NTOTAP•NASYM	SPLA	AERO FORCE INTEGR MAT (ASM)
FDL2	8	N1S	2•NSYM2•NK	DSALL	SYM. GEN. AERO (ALL NK)
	9	N2S	2•NTOTAP•NK	FSALL	SYM. GEN. GUST (ALL NK)
	10	N3S	NTOTAP•NK	RS	SYM. MODULUS GUST (ALL NK)
	11	N4S	NTOTAP•NK	TANS	SYM. PHASE GUST (ALL NK)
	12	N5S	2•NTOTAP	FS	SYM. GUST FORCE
	13	N1A	2•NASYM2•NK	DAALL	ASYM. GEN. AERO (ALL NK)
	14	N2A	2•NTOTAP•NK	FAALL	ASYM. GEN. GUST (ALL NK)
	15	N3A	NTOTAP•NK	RA	ASYM. MODULUS GUST (ALL NK)
	16	N4A	NTOTAP•NK	TANA	ASYM. PHASE GUST (ALL NK)
	17	N5A	2•NTOTAP	FA	ASYM. GUST FORCE

DEFINITIONS:

NMMX	MAX(NSYM,NASYM)
NVBW	NO. FREQUENCIES FOR SOLUTION (NFREQ)
NM	TOTAL NO. MODES (NSYM+NASYM)
NK	NO. HARD POINT AERO MATRICES
NTOTAP	TOTAL NO. AERO ELEMENTS (NBOX+2•NSBETO)
NSYM	NO. SYM MODES
NASYM	NO. ASYM MODES
NSYM2	NSYM•NSYM
NASYM2	NASYM•NASYM

TABLE 9

UNIT GUST LOAD MODULE ARRAY DIMENSIONING

DIM. LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
GDL1	1	L60	NFREQ	PLOTF	PLOTTING ARRAY
	2	L61	NFREQ	PLOTV	PLOTTING ARRAY
	3	L1	NINTLD•NFREQ	PS	SYMMETRIC UNIT GUST LOADS
	4	L2	NINTLD•NFREQ	PA	ANTISYMMETRIC UNIT GUST LOADS
	5	L3	NFREQ	OMEGA	FREQUENCIES (RAD/SEC)
	5A	L3A	2•NACC	INDACC	ACCELERATION INDICES
GDL2	6	L4	NK•NFREQ	COEF	INTERPOLATION COEFFICIENTS
	7	L5	2•NM•NFREQ	Q	GEN. RESPONSES
GDL3	8	L6	NINTLD•NM	PIQ	INERTIA FORCES DUE TO GEN. RESPONSE
GDL4	8	L7	2•NINTLD•NSYM	PAQS	AERO FORCES DUE TO SYM RESP.
	9	L8	2•NINTLD•NASM	PAQA	AERO FORCES DUE TO ASYM RESP.
GDL5	6	L51	NINTLD	SYMCOD	CENTERLINE LOAD MOD (SYM)
	7	L52	NINTLD	ASMCOD	CENTERLINE LOAD MOD (ASYM)
	8	L9	3•NABGRP	NFNLAB	SEE LOAD
	9	L10	3•NSBGRP	NFNLSB	SEE LOAD
	10	L11	LENGTHA	PINTP	SEE LOAD
	11	L12	LENGTHB	PINTZ	SEE LOAD
	12	L13	LENGTHB	PINTY	SEE LOAD
GDL6	13	L62	2•NTOTAP	FGPS	SYM GUST FORCES
GDL7	13	L63	2•NTOTAP	FGPA	ASYM GUST FORCES

DEFINITIONS:

NFREQ	NO. FREQUENCIES FOR SOLUTION
NINTLD	NO. INTEGRATED LOADS
NK	NO. HARD POINT AERO MATRICES
NM	NO. TOTAL MODES (NSYM+NASM)
NSYM	NO. SYMMETRIC MODES
NASM	NO. ANTISYMMETRIC MODES
NABGRP	NO. AERO BOX GROUPS
NSBGRP	NO. SLENDER BODY ELEMENT GROUPS
NBOXES	MAX NO. AERO BOXES IN ANY NABGRP BOX GROUP
NAERSE	MAX NO. SLENDER BODY ELEMENTS IN ANY NSBGRP BODY GROUP
LENGTHA	NINTLD•NABGRP•NBOXES
LENGTHB	NINTLD•NSBGRP•NAERSE
NTOTAP	TOTAL NO. AERO ELEMENTS (NBOX+2•NSBETO)

TABLE 10

TRIM MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
TDL1	1	L1	NM	Q	GEN. STATIC RESPONSE
	2	L2	NM	QDOT	GEN. STATIC RATE RESPONSE
	3	L14	NINTLD•NENGS	THRLOD	INTGD LOADS DUE TO THRUST
	4	L15	NSYM•NENGS	THRGNF	GEN. FORCE DUE TO THRUST
TDL2	5	L3	NMS•NMS	ZSYM	SYM. EQNS. STATIC TRIM
	6	L4	NMS	FSYM	RHS EQNS. STATIC TRIM
	7	L5	2•NSYM•NSYM	DSYM	GEN. SYM AERO
TDL3	5	L6	NMA•NMA	ZASYM	ASYM. EQNS. STATIC TRIM
	6	L7	NMA	FASYM	RHS EQNS. STATIC TRIM
	7	L8	2•NASM•NASM	DASYM	GEN. ASYM AERO
TDL4	5	L11	NINTLD•NM	PIQ	INTGD INERTIAL LOADS, INERTIAL RESPONSE
TDL5	5	L12	2•NINTLD•NSYM	PAQS	INTGD SYM LOADS, AERO GEN. RESPONSE
	6	L13	2•NINTLD•NASM	PAQA	INTGD ASM LOADS, AERO GEN. RESPONSE

DEFINITIONS:

NM	NO. TOTAL MODES (NSYM+NASM)
NSYM	NO. SYM MODES
NASM	NO. ASM MODES
NINTLD	NO. INTGD LOADS
NENGS	NO. ENGINES
NMS	2+NO. ELASTIC MODES (SYM)
NMA	3+NO. OF ELASTIC MODES (ASYM)

TABLE 11

BLAST AND TIME HISTORY MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
BDI1	1	L1	NINTLD	PSTR	SYM. TRIM LOADS
	2	L2	NINTLD	PATR	ASM. TRIM LOADS
	3	L21	NSTRSS•NINTLD	STRESS	STRESS/INTGD LOAD
	4	L22	NENGS	THRUST	ENGINE THRUST
	5	L23	NINTLD	SYMCOD	CENTER LINE LOAD MOD. (SYM)
	6	L24	NINTLD	ASMCOD	CENTER LINE LOAD MOD. (ASYM)
BDL2	7	L3	NORMAX	NOR	BLAST ORIENTATION CODES
	8	L4	NORMAX	REST	BLAST ESTIMATED RANGES
	9	L5	8•NINTLD	STALDS	INTEGRATED LOAD DEFINITION
	10	L6	NFREQ	OMEGA	FREQUENCIES (RAD/SEC)
	11	L7	LENGTH	PS	SYM. GUST LOADS (FREQ DOMAIN)
	11	L7	NSTRSS•NTMRSP	STR	RIGHT SIDE STRESSES
	12	L8	LENGTH	PA	ASM. GUST LOADS (FREQ DOMAIN)
	12	L8	NSTRSS•NTMRSP	STL	LEFT SIDE STRESSES
	13	L9	NTMGST	VELG	GUST VELOCITY
	14	L10	NTMGST	TIMG	GUST VELOCITY TIMES
	15	L11	NTMGST	RHO	GUST DENSITY
	16	L12	NFREQ	PLOTF	PLOT ARRAY
	17	L13	NFREQ	PLOTA	PLOT ARRAY
	18	L14	2•NFREQ	FTG	FOURIER TRANSFORM OF VELG•RHO
	19	L15	NINTLD•NTMRSP	PST	RIGHT SIDE LOADS (TIME DOMAIN)
	20	L16	NINTLD•NTMRSP	PAT	LEFT SIDE LOADS (TIME DOMAIN)
	21	L17	NTMRSP	TIME	LOAD TIMES
	22	L18	MAX1	PKL	PEAK LOADS (OR STRESSES)
	23	L19	NINTLD•2	ALLOWS	MAX. ALLOWABLE STRESSES
	11	L7	6•NBOX	GEOMBX	BOX AAS COORDINATES
	12	L8	6•NSBETO	GEOMBD	BODY AAS COORDINATES

DEFINITIONS:

NINTLD	NO. INTEGRATED LOADS
NSTRSS	NO. STRESSES
NENGS	NO. ENGINES
NORMAX	NO. ORIENTATIONS TO ANALYZE
NFREQ	NO. FREQUENCY SOLUTIONS
NTMRSP	NO. SOLUTION TIME POINTS
NTMGST	NO. GUST HISTORY TIME POINTS
NBOX	NO. PANEL BOXES
NSBETO	NO. SLENDER BODY ELEMENTS
LENGTH	2•NINTLD•NFREQ
MAX1	MAX(NINTLD•8,NSTRSS•8)

TABLE 12

RIGID MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
RDL1	1	L1	NFREQ	OMEGA	FREQUENCIES
	2	L2	MAX1	TIME	TIME
	3	L3	NFORC	GEOM	FORCE GEOMETRY
	4	L4	2•NFORC	CPT	FORCES DUE TO TRIM
	5	L5	2•NFORC•NFREQ	CP	FORCES AND PRESSURES VS FREQ
RDL2	6	L6	NBOX	IBOXES	AERO BOX NUMBERS
	6A1	L7	2•NSBE	ISBES	SLENDER BODY ELEMENTS
	6A2	L8	NSYM	Q	GENERALIZED COORDINATES
	6A3	L20	2•NFORC•NK	FI	INPUT AERO GUST FORCES
	6A4	L21	NK	VOBUS	REDUCED VELOCITIES FROM AERO
	6A5	L22	NFORC•NK	RS	MODULUS GUST
	6A6	L23	NFORC•NK	TANS	PHASE GUST
	6A5	L9	MBOX•5	GEOP	PANEL GEOMETRY
	6A5	L10	MSBE•6	GEOS	BODY GEOMETRY
	6A5	L10A	3•NORMAX	CR	GUST DIRECTION COSINES
	6A5	L11	2•MBOX•MAX2	D	BOX AERODYNAMICS
	6A5	L12	2•MSBE•MAX2	DB	SLENDER BODY AERO
RDL3	6	L13	NTMGST	DP	OVERPRESSURE
	6B1	L14	NTMGST	RHO	GUST DENSITY
	6B2	L15	NTMGST	VG	MATERIAL VELOCITY
	6B3	L16	NFREQ	PLOTF	PLOT ARRAY
	6B4	L17	MAX3	PLOTA	PLOT ARRAY
	6B5	L18	2•NFREQ	FTG	FOURIER TRANSFORM OF VG•RHO
	6B6	L19	NFORC•NTMRSP	P	FORCES & PRESSURES VS TIME

DEFINITIONS:

NFREQ	NO. FREQUENCY SOLUTIONS
NTMGST	NO. GUST HISTORY TIME POINTS
NTMRSP	NO. SOLUTION TIME POINTS
NFORC	NO. OF FORCES
NBOX	NO. OF AERO BOXES
NSBE	NO. OF SLENDER BODY POINTS
NSYM	NO. OF SYMMETRIC MODES
NK	NO. OF REDUCED FREQUENCIES ON AERO FILE
MBOX	NO. OF AERO BOXES ON AERO FILE
MSBE	NO. OF SLENDER BODY ELEMENTS ON AERO FILE
NORMAX	NO. OF ORIENTATIONS TO BE ANALYZED
NGUST	NO. OF GUST ORIENTATIONS ON AERO FILE
MAX1	MAX (NTMGST, NTMRSP)
MAX2	MAX (NSYM, NGUST)
MAX3	MAX (NFREQ, NTMRSP)

TABLE 13

MERGE MODULE ARRAY DIMENSIONING

DIM LEVEL	REL LOC	PROG ID	LENGTH	ARRAY NAME	DEFINITION
XDL1	1	L1	INK1	RKIN1	FREQUENCIES TO BE MERGED FROM TAPE17 FILE
	2	L2	INK2	RKIN2	FREQUENCIES TO BE MERGED FROM TAPE18 FILE
	3	L3	INK1+INK2	RK	DESIRED FREQS ON TAPE19 FILE
	4	L4	NK1	RK1	REDUCED FREQS ON TAPE17 FILE
	5	L5	NK2	RK2	REDUCED FREQS ON TAPE18 FILE
	6	L6	LENGTH	WORK	WORK ARRAY

DEFINITIONS:

INK1	NO. OF FREQUENCIES TO BE MERGED FROM TAPE17 FILE
INK2	NO. OF FREQUENCIES TO BE MERGED FROM TAPE18 FILE
NK1	NO. OF FREQUENCIES ON TAPE17 FILE
NK2	NO. OF FREQUENCIES ON TAPE18 FILE
LENGTH	6•MAX(NBOX,NSBE)
NBOX	NO. OF AERO BOXES
NSBE	NO. OF SLENDER BODY ELEMENTS

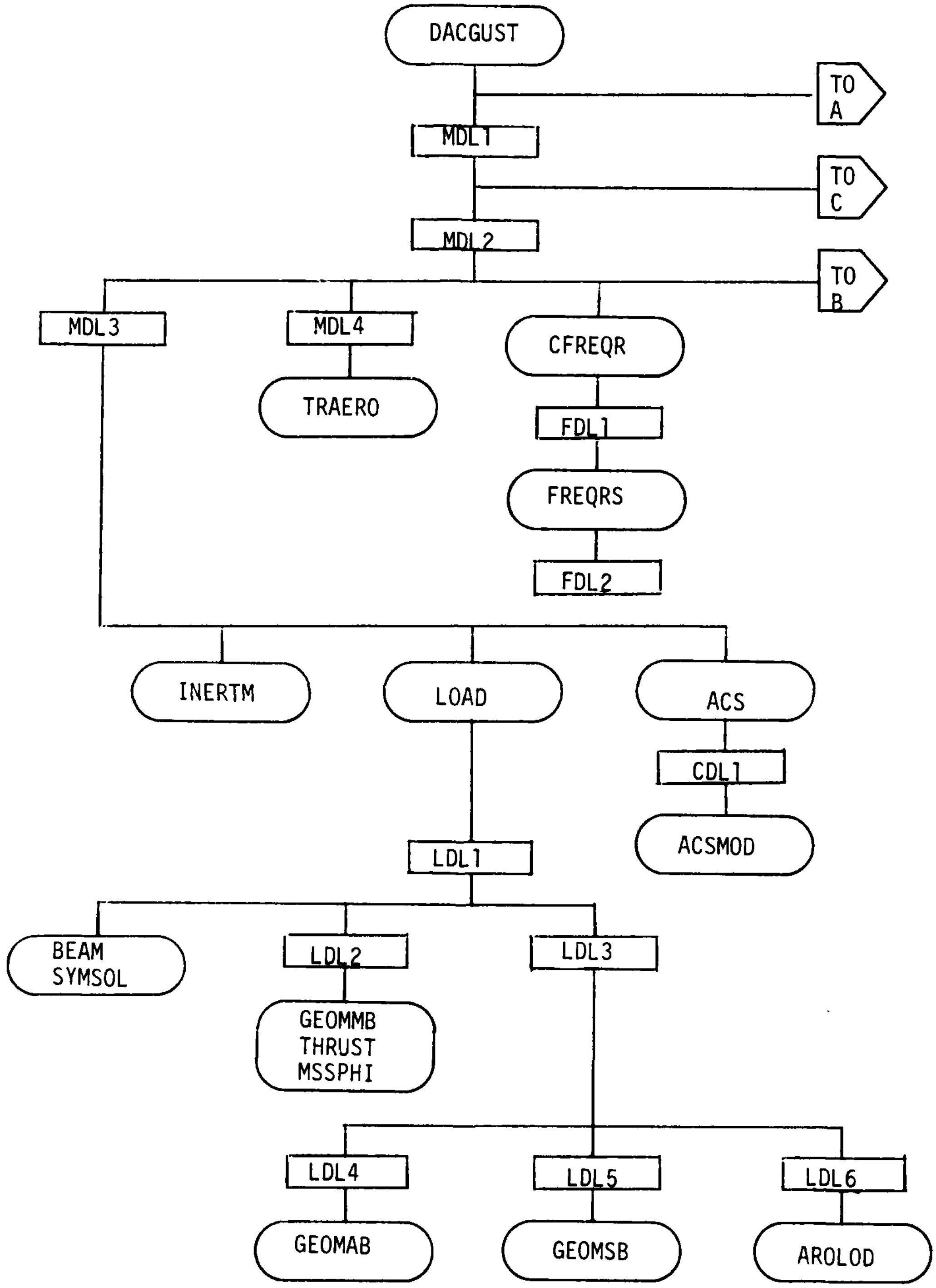


Figure 22. Dynamic Core Overlay Structure

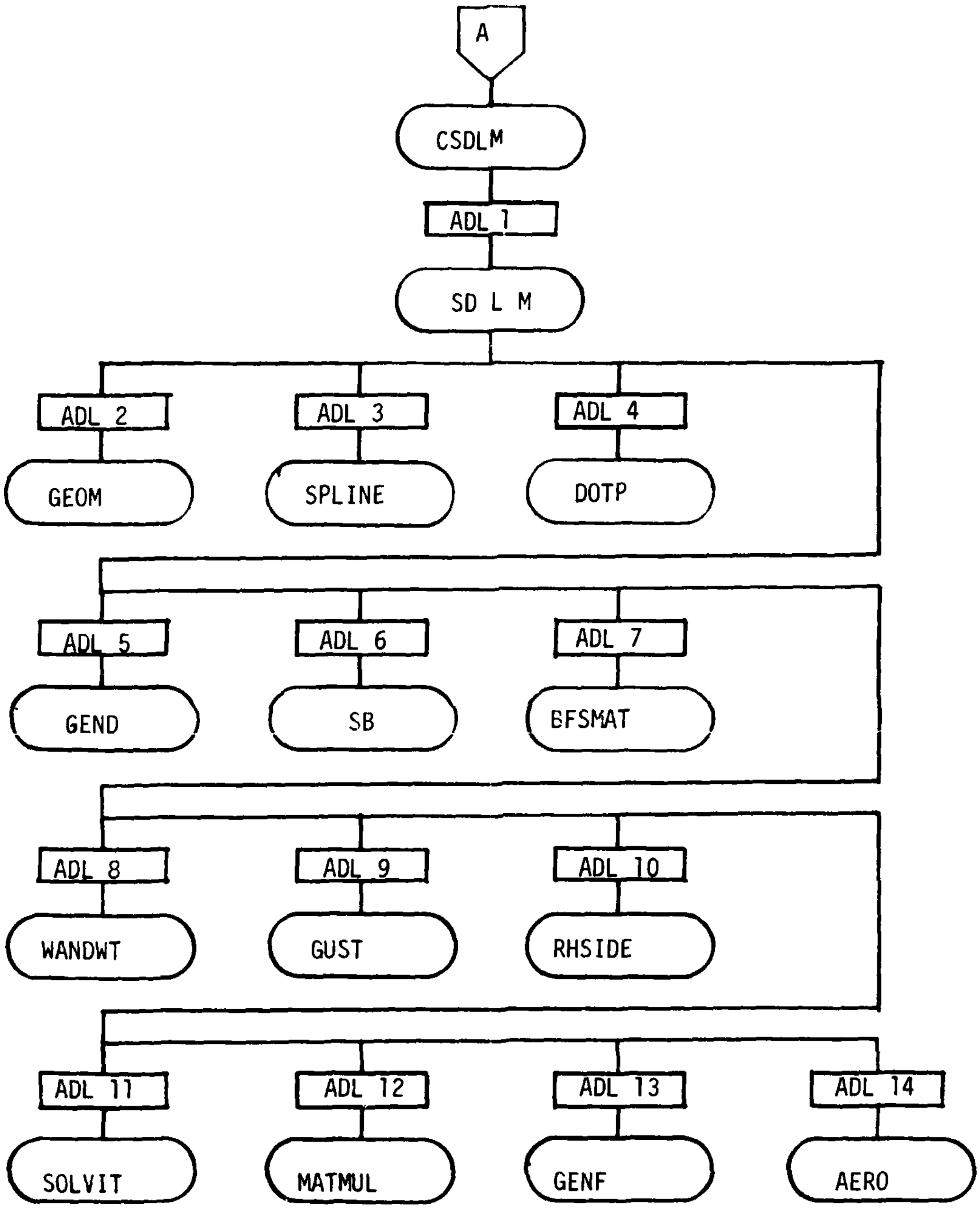
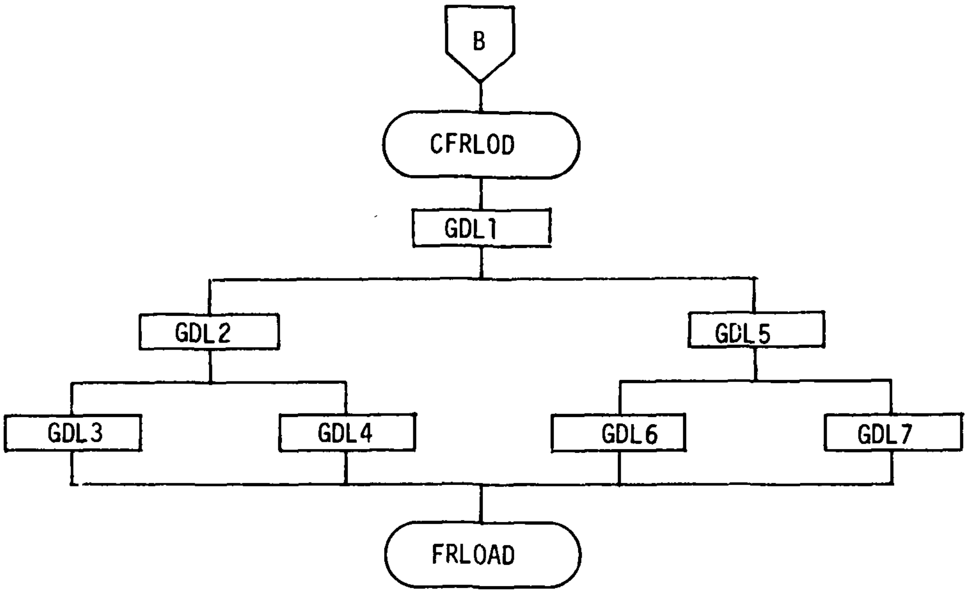


Figure 22 (cont'd). Dynamic Core Overlay Structure



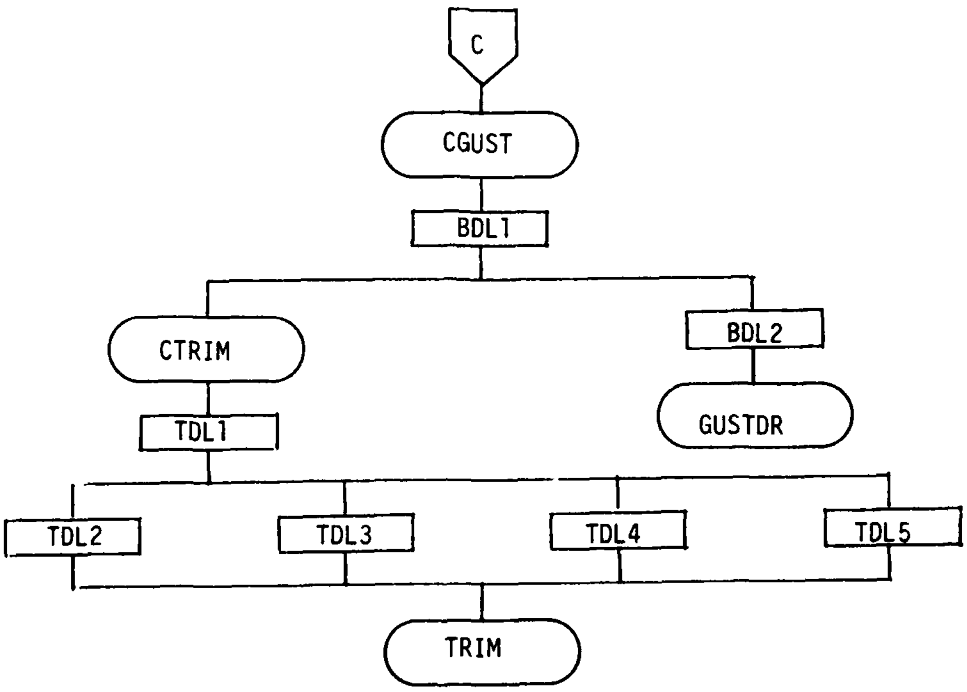


Figure 22 (Cont'd). Dynamic Core Overlay Structure

TABLE 14

CENTRAL MEMORY REQUIREMENTS

MODULE	CENTRAL MEMORY (DECIMAL WORDS)
Program	40,000
AERO	ADL1 + MAX (ADL6, ADL 11, ADL 12)
UNIT	MDL1 + MDL2 + MDL3 + LDL1 + LDL3 + LDL6
ACSM	Other modules are always longer
FRSP	MDL1 + MDL2 + FDL1 + FDL2
GUST	MDL1 + MDL2 + GDL1 + GDL5 + GDL6
BLST	MDL1 + BDL1 + BDL2
RIGD	RDL1 + MAX (RDL2, RDL3)
MERG	XDL1

Note: If more than one module is to be executed then the amount of central memory required is that necessary for the longest module.

TABLE 15

XTF COMMON BLOCK DESCRIPTION

Loc	Variable	Description
1	AMACH	Mach number
2	GAMX	direction cosine in x-direction for current gust orientation
3	VSS	speed of sound
4	PO	atmospheric pressure at altitude
5	NMS	number of 'right hand side' mass points, including centerline masses
6	NSYM	number of symmetric modes
7	NASYM	number of antisymmetric modes
8	NOMOD	total number of modes, NSYM + NASYM
9	NFREQ	number of frequencies in frequency response
10	NENGS	number of engines on right hand side and centerline
11	IDENT	identification number of configuration
12	BZERO	reference semi-chord
13	RHOO	density at sea level
14	SIGMA	density ratio
15	EQUVAS	equivalent airspeed factor
16	IUNITS	airspeed units flag; = 2, knots
17	VKEAS	velocity, equivalent airspeed in knots
18	VTFPS	velocity, true airspeed in ft/sec
19	ALT	altitude, ft
20	KPFCHK	=nm, print all matrices in frequency response and unit gust load calculations for orientations n and m
21	KPFCXI	=nm, print generalized response (q) and integrated loads (P) due to unit gust for orientations n and m
22	KPRBLS	=1, print load time history matrices
23	KPFTPM	=1, print all matrices in trim solution
24	KPRLDS	=1, print unit load matrices
25	KPFTMH	=1, print total load time history
26	IPLQ	=n, plot generalized response (q) for nth orientation
27	IPLL	=n, plot nth load due to unit gust for all orientations
28	IPLBL	=1, plot load time histories for RHS of aircraft =2, plot load time histories for LHS of aircraft =3, plot both RHS and LHS
29	NACC	number of accelerations
31	NBEAMS	number of beams for integrated loads
32	NINTLD	number of integrated loads
33	NSTRSS	number of stresses
34	NMGRP	number of groups of masses associated with beams

TABLE 15 (CONT'D)

XTF COMMON BLOCK DESCRIPTION

Loc	Variable	Description
35	NABGRP	number of groups of aerodynamic boxes associated with beams
36	NSBGRP	number of groups of aerodynamic slender body elements associated with beams
37	NBOXES	maximum number of aerodynamic boxes per group
38	NAERSB	maximum number of aerodynamic slender body elements per group
41	NK	number of reduced frequencies
42	NG	number of gust orientations
43	NBOX	number of aerodynamic lifting surface boxes
44	NSBETO	number of aerodynamic slender body elements
45	NB	number of aerodynamic bodies
46	NTOTAP	number of total aerodynamic points
48	IDIMUL	dimension constant for unit loads
51	AN	load factor
52	ZDOT	climb rate
53	RTURN	turn radius
54	KMAN	manuever constant =0, no manuever =1, symmetric pull-up or push-over =2, turn
55	AB	bank angle
56	AC	climb angle
57	INDSYM	symmetry indicator
61	NORMAX	maximum number of orientations to be considered
62	TIMEMX	maximum time for time history, sec.
63	EFR	weapon yield, KT
64	KGRD	control constant for ground reflection =0, no ground reflection =1, include ground reflection
65	KLPT	=1, iteration for critical range desired =0, no iteration
66	HGRD	height of ground above sea level, ft
67	KLOAD	=1, new max allowable loads input
68	NCRITS	=1, max stresses input

TABLE 15 (CONT'D)

XTF COMMON BLOCK DESCRIPTION

Loc	Variable	Description
70	MXORD	maximum potential order of any transfer function
71	MXORSN	maximum order of numerator of symmetric transfer function
72	MXORSD	maximum order of denominator of symmetric transfer function
73	MXORAN	maximum order of numerator of antisymmetric transfer function
74	MXORAD	maximum order of denominator of antisymmetric transfer function
75	NTFS	number of symmetric transfer functions
76	NTFA	number of antisymmetric transfer functions
80	ISECT	≠0, sectional input data available
81	NDOF	number of degrees of freedom per mass station
82	IMS	number of mass property items =1, for mass point data =10, for NDOF=6 =16, for NDOF=7 =23, for NDOF=8
91	FINFRQ	final estimated frequency for zero forcing function modulus
92	NFG	number of first gust
93	NLG	number of last gust
96	IPRNTM	print flag for inertial module
97	DELT	initial delta time for solutions
99	RBRADF	scale factor for rotation modes
100	SIZFCT	size factor defining units of the input geometry data relative to inches

TABLE 16

AFOCOM COMMON BLOCK DESCRIPTION

Loc	Variable	Description
1	NTI	unit designator for fixed data deck (=31)
2	MODES	number of modes
3	NP	total number of panels on all lifting surfaces
4	MSTRIP	maximum number of strips for all panels (for dimensioning)
5	NSMAX	max number of strips per panel
6	NCMAX	max number of chordwise boxes per panel
7	NTOTAL	total number of lifting surface boxes + 2MSBE
8	NB	total number of bodies
9	MSBE	maximum number of interference body elements (for dimensioning)
10	MBE	maximum number of interference body elements (for dimensioning)
11	ND	not used
12	NE	ground effect lag
13	NBY	number of y-oriented bodies
14	NBZ	number of z-oriented bodies
15	NTO	=NTP+NTY+NTZ (see below)
16	NTP	total number of lifting surface boxes
17	NTY	number of y-oriented interference body elements
18	NTZ	number of z-oriented interference body elements
19	NTYS	number of y-oriented slender body elements
20	NTZS	number of z-oriented slender body elements
21	MAXGR	number of components (groups of panels)
22	MAXSTR	number of superstrips on all panels
23	NSBETO	total number of slender body elements
24	NSTRIP	number of lifting surface strips
25	KR	reduced frequency
26	XM	moment axis
27	REFA	reference area
28	REFC	reference chord
29	REFS	reference semi-span
30	FMACH	Mach number
31	LINES	maximum number of print lines per page

TABLE 17

ZZZ COMMON BLOCK DESCRIPTION

Loc	Variable	Description
1-30	HEDR	case header information
31-42	TITLE	matrix title information
43-48	DT	date and time
49	NIN	fortran unit designator for input data, =5
50	NOUT	fortran unit designator for output data, =6
51	KROW	maximum number of lines per page
52	LINES	number of lines printed on current page
53	IPRNT	print flag
54	NER	error flag

TABLE 18

DISK2 COMMON BLOCK DESCRIPTION

Loc	Variable	Description
1	ND2	fortran unit number for mass storage data, =2
2-842	ITBL2	table of record numbers of start of data items
843	NRECSA	total number of records
844	NKD	number of reduced frequencies
845	NG	number of gust orientations
846	IBUMP	2(1+NG)
847	VOBWS	reduced velocities

TABLE 19

DDTBLS COMMON BLOCK DESCRIPTION

COMMON /DDTBLS/DDTBL(20,10)

Loc	Variable	Description
AERODYNAMIC FILE (TABLE 1)		
1,1	NT	unit designator, =19
2,1	TYPE	file type, =4HAERO
3,1	INOUT	=1, input; =2, input and output; =3, output
4,1	STAT	current status: =1, read; =0, write
5,1	LRN	last record number processed
10,1	NK	number of reduced frequencies
11,1	NSYM	number symmetric modes
12,1	NASYM	number of antisymmetric modes
13,1	NGUST	number of gust orientations
14,1	NB	number of bodies
15,1	NBOX	number of lifting surface boxes
16,1	NSBETO	number of slender body elements
17,1	NSTRIP	number of strips
18,1	MAXSTR	number of superstrips
19,1	NP	number of panels
20,1	NER	=0, no errors processing data =1, error occurred reading =2, error occurred writing
UNIT LOAD FILE (TABLE 4)		
1,4	NT	unit designator, =34
2,4	TYPE	file type, =4HUNIT
3,4	INOUT	=1, input; =2, input and output; =3, output
4,4	STAT	current status: =1, read; =0, write
5,4	LRN	last record number processed
10,4	NINTLD	number of integrated loads
11,4	NSTRSS	number of stresses
12,4	NENGS	number of engines for thrust calculations
13,4	NSYM	number of symmetric modes
14,4	NASYM	number of antisymmetric modes
15,4	NK	number of reduced frequencies
16,4	NABGRP	number of aero box groups
17,4	NSBGRP	number of slender body groups
18,4	NBOXES	maximum number of boxes per aero group
19,4	NAERSB	maximum number of slender body elements per slender body group
20,4	NER	=0, no errors processing data =1, error occurred reading =2, error occurred writing

TABLE 19 (CONT'D)

DITELS COMMON BLOCK DESCRIPTION

Loc	Variable	Description
FREQUENCY RESPONSE FILE (TABLE 5)		
1,5	NT	unit designator, =35
2,5	TYPE	file type, =4HFRSP
3,5	INOUT	=1, input; =2, input and output; =3, output
4,5	STAT	current status: =1, read; =0, write
5,5	LRN	last record number processed
11,5	NGUST	number of gust orientations
12,5	NFREQ	number of frequencies
13,5	NSYM	number symmetric modes
14,5	NASYM	number of antisymmetric modes
15,5	NK	number of reduced frequencies used in interpolations
16,5	NTOTAP	number of total aero points
17,5	NFG	number of first gust
20,5	NER	=0, no errors processing data =1, error occurred reading =2, error occurred writing
UNIT GUST LOADS FILE (TABLE 6)		
1,6	NT	unit designator, =36
2,6	TYPE	file type, =4HLOAD
3,6	INOUT	=1, input; =2, input and output; =3, output
4,6	STAT	current status: =1, read; =0, write
5,6	LRN	last record number processed
11,6	NGUST	number of gust orientations
12,6	NFREQ	number of frequencies
13,6	NINTLD	number of integrated loads
14,6	NACC	number of accelerations
20,6	NER	=0, no errors processing data =1, error occurred reading =2, error occurred writing

TABLE 20

AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
1	1	TYPE	data set type (=4HAERO)
	2	NK	number of reduced frequencies
	3	NSYM	number of symmetric modes
	4	NASYM	number of antisymmetric modes
	5	NGUST	number of gust orientations
	6	NB	number of bodies
	7	NBOX	number of lifting surface boxes
	8	NSBE	number of slender body elements
	9	NSTRIP	number of lifting surface strips
	10	MAXSTR	number of superstrips on all panels
	11	NP	number of panels on all lifting surfaces
	12-20	-	not used
	21	FMACH	mach number
	22	REFA	reference area
	23	REFS	reference semi-span
	24	REFC	reference chord
	25	XM	moment axis
	26-50	-	not used
2	1-N	DELA	box areas (DELA(I),I=1,NBOX)
		DELX	box chords (DELX(I),I=1,NBOX)
		XIC	XAAS of centerline of 1/4 chord of boxes (XIC(I),I=1,NBOX)
		CG	cosine of dihedral angle of strips (CG(I),I=1,NSTRIP)
		CS	chord length of strips (CS(I),I=1,NSTRIP)
		EE	half width of strips (EE(I),I=1,NSTRIP)
		SG	sine of dihedral angle of strips (SG(I),I=1,NSTRIP)
		YS	YAAS of centerline of strips (YS(I),I=1,NSTRIP)
		ZS	ZAAS of centerline of strips (ZS(I),I=1,NSTRIP)
		XIJ	XAAS of leading edge of strip centerline (XIJ(I),I=1,NSTRIP)
		ISSTR	superstrip number of each strip (ISSTR(I),I=1,NSTRIP)
		COORD	spanwise coordinate of strips (COORD(I),I=1,MAXSTR)
		NBARAY	last box number of each panel (NBARAY(I),I=1,NP)
		NCARAY	number of chordwise boxes per panel (NCARAY(I),I=1,NP)
		NSBEA	number of slender body elements per body (NSBEA(I),I=1,NB)

TABLE 20 (CONT'D)

AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
		YB	YAAS of body centerlines(YB(I),I=1,NB)
		ZB	ZAAS of body centerlines (ZB(I),I=1,NB)
3	1-N	XI1	XAAS of inboard edge of 1/4 chord of boxes (XI1(I),I=1,NBO
		ETA1	YAAS of inboard edge of 1/4 chord of boxes (ETA1(I),I=1,NBOX)
		ZETA1	ZAAS of inboard edge of 1/4 chord of boxes (ZETA1(I),I=1, OX)
		XI2	XAAS of outboard edge of 1/4 chord of boxes (XI2(I),I=1,NBOX)
		ETA2	YAAS of outboard edge of 1/4 chord of boxes (ETA2(I),I=1,NBOX)
		ZETA2	ZAAS of outboard edge of 1/4 chord of boxes (ZETA2(I),I=1,NBOX)
4	1-N	X	XAAS of centerline of 3/4 chord of boxes (X(I),I=1,NBOX)
		ETA	YAAS of centerline of 3/4 chord of boxes (ETA(I),I=1,NBCX)
		ZETA	ZAAS of centerline of 3/4 chord of boxes (ZETA(I),I=1,NBOX)
Record type 5 is omitted if NB=0			
5	1-N	XIS1	XAAS of leading edge of slender body elements (XIS1(I),I=1,NSBE)
		ETAS1	YAAS of leading edge of slender body elements (ETAS1(I),I=1,NSBE)
		ZETAS1	ZAAS of leading edge of slender body elements (ZETAS1(I),I=1,NSBE)
		XIS2	XAAS of trailing edge of slender body elements (XIS2(I),I=1,NSBE)
		ETAS2	YAAS of trailing edge of slender body elements (ETAS2(I),I=1,NSBE)
		ZETAS2	ZAAS of trailing edge of slender body elements (ZETAS2( ),I=1,NSBE)
6	1-N	CR	direction cosines of gust orientations ((CR(I,J),I=1,3), =1,NGUST)
7	1-NK	RK	reduced frequencies

TABLE 20 (CONT'D)

AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
8	1-NBOX	HPS	deflection at 1/4 chord of boxes due to symmetric modes
	Repeated for J=1,NSYM		
Record type 9 is omitted if NASYM=0			
9	1-NBOX	HPA	deflection at 1/4 chord of boxes due to antisymmetric modes
	Repeated for J=1,NASYM		
Record types 10 thru 13 are omitted if NB=0			
10	1-NSBE	HZS	deflection in z-direction at midpoint of slender body elements due to symmetric modes
	Repeated for J=1,NSYM		
Record type 11 is omitted if NASYM=0			
11	1-NSBE	HZA	deflection in z-direction at midpoint of slender body elements due to antisymmetric modes
	Repeated for J=1,NASYM		
12	1-NSBE	HYS	deflection in y-direction at midpoint of slender body elements due to symmetric modes
	Repeated for J=1,NSYM		
Record type 13 is omitted if NASYM=0			
13	1-NSBE	HYA	deflection in y-direction at midpoint of slender body elements due to antisymmetric modes
	Repeated for J=1,NASYM		

TABLE 20 (CONT'D)

AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
Record types 14 thru 31 are repeated for K=1,NK			
Record types 14 thru 31 are all complex type arrays			
14	1-NBOX	DPOS	forces on lifting surface boxes due to symmetric modes
	Repeated for J=1,NSYM		
15	1-NBOX	FGPS	forces on lifting surface boxes due to symmetric gusts
	Repeated for J=1,NGUST		
Record types 16 thru 19 are omitted if NB=0			
16	1-NSBE	DZOS	forces on z-oriented slender body elements due to symmetric modes
	Repeated for J=1,NSYM		
17	1-NSBE	FGZS	forces on z-oriented slender body elements due to symmetric gusts
	Repeated for J=1,NGUST		
18	1-NSBE	DYOS	forces on y-oriented slender body elements due to symmetric modes
	Repeated for J=1,NSYM		
19	1-NSBE	FGYS	forces on y-oriented slender body elements due to symmetric gusts
	Repeated for J=1,NGUST		
Record types 20 thru 25 are ommited if NASYM=0			
20	1-NBOX	DPOA	forces on lifting surface boxes due to antisymmetric modes
	Repeated for J=1,NASYM		
21	1-NBOX	FGPA	forces on lifting surface boxes due to antisymmetric gusts
	Repeated for J=1,NGUST		
Record types 22 thru 25 are omitted if NB=0			
22	1-NSBE	DZOA	forces on z-oriented slender body elements due to antisymmetric modes
	Repeated for J=1,NASYM		

TABLE 20 (CONT'D)

AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
23	1-NSBE	FGZA	forces on z-oriented slender body elements due to antisymmetric gusts
	Repeated for J=1,NGUST		
24	1-NSBE	DYOA	forces on y-oriented slender body elements due to antisymmetric modes
	Repeated for J=1,NASYM		
25	1-NSBE	FGYA	forces on y-oriented slender body elements due to antisymmetric gusts
	Repeated for J=1,NGUST		
26	1-N	DPOS	generalized forces on lifting surfaces due to symmetric modes ((DPOS(I,J),I=1,NSYM),J=1,NSYM)
		FGPS	generalized forces on lifting surfaces due to symmetric gusts ((FGPS(I,J),I=1,NSYM),J=1,NGUST)
Record types 27 and 28 are omitted if NB=0			
27	1-N	DZOS	generalized forces on z-oriented slender bodies due to symmetric gusts ((DZOS(I,J),I=1,NSYM),J=1,NSYM)
		FGZS	generalized forces on z-oriented slender bodies due to symmetric gusts ((FGZS(I,J),I=1,NSYM),J=1,NGUST)
28	1-N	DYOS	generalized forces on y-oriented slender bodies due to symmetric modes ((DYOS(I,J),I=1,NSYM ,J=1,NSYM)
		FGYS	generalized forces on y-oriented slender bodies due to symmetric gusts ((FGYS(I,J),I=1,NSYM),J=1,NGUST)
Record types 29 thru 31 are omitted if NASYM=0			
29	1-N	DPOA	generalized forces on lifting surfaces due to antisymmetric modes ((DPOA(I,J),I=1,NASYM),J=1,NASYM)
		FGPA	generalized forces on lifting surfaces due to antisymmetric gusts ((FGPA(I,J),I=1,NASYM),J=1,NGUST)

TABLE 20 (CONT'D)

AERODYNAMIC (AERO) FILE DESCRIPTION

Record type	Word	Item	Description
Record types 30 and 31 are omitted if NB=0			
30	1-N	DZOA	generalized forces on z-oriented slender bodies due to antisymmetric modes ((DZOA(I,J),I=1,NASYM),J=1,NASYM)
		FGZA	generalized forces on z-oriented slender bodies due to antisymmetric gusts ((FGZA(I,J),I=1,NASYM),J=1,NGUST)
31	1-N	DYOA	generalized forces on y-oriented slender bodies due to antisym etric modes ((DYOA(I,J),I=1,NASYM ,J=1,NASYM)
		FGYA	generalized forces on y-oriented slender bodies due to antisymmetric gusts ((FGYA(I,J),I=1,NASYM),J=1,NGUST)

TABLE 21

UNIT LOAD (UNIT) FILE DESCRIPTION

Record type	Word	Item	Description
1	1	TYPE	data set type (=4HUNIT)
	2	IDENT	identification number
	3	NINTLD	number of integrated loads
	4	NSTRSS	number of stresses
	5	NENGS	number of engines for thrust calculation
	6	NSYM	number of symmetric modes
	7	NASYM	number of antisymmetric modes
	8	NK	number of reduced frequencies
	9	NABGRP	number of aero box groups
	10	NSBGRP	number of slender body groups
	11	NBOXES	maximum no. of boxes per aero box group
	12	NAERSB	maximum no. of slender body elements per slender body group
2	1-N	STALDS	Integrated load definitions ((STALDS(I,J),I=1,NINTLD),J=1,8)
3	1-N	STRESS	Stress definition matrix ((STRESS (I,J),I=1,NSTRSS),J=1,NINTLD)
4	1-N	THRLOD	Integrated loads due to thrust ((THRLOD(I,J),I=1,NINTLD),J=1,NENGS)
5	1-N	THRGNF	Generalized loads due to thrust ((THRGNF(I,J),I=1,NSYM),J=1,NENGS)
6	1-N	PIQ	Integrated inertial loads due to unit modal amplitudes ((PIQ(I,J),I=1,NINTLD),J=1,NM) where NM=NSYM+NASYM
Record types 7 and 8 are repeated for K=1,NK			
7	1-N	PAQS	Integrated aero loads due to unit modal amplitudes for symmetric modes ((PAQS(I,J),I=1,NINTLD),J=1,NSYM)
8	1-N	PAQA	Integrated aero loads due to unit modal amplitudes for antisymmetric modes ((PAQA(I,J),I=1,NINTLD),J=1,NASYM)
9	1-N	SYMCOD	Symmetric centerline load modifier (SYMCOD(I),I=1,NINTLD)

AD-A106 480 DOUGLAS AIRCRAFT CO LONG BEACH CA F/G 18/3
NUCLEAR BLAST RESPONSE COMPUTER PROGRAM. VOLUME I. PROGRAM DESC--ETC(U)
AUG 81 J A MCGREW, J P GIESING, T P KALMAN DNA001-75-C-0216
UNCLASSIFIED AFWL-TR-81-32-VOL-1 NL

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TABLE 21 (CONT'D)

UNIT LOAD (UNIT) FILE DESCRIPTION

Record type	Word	Item	Description
10	1-N	ASMCOD	Antisymmetric centerline load modifier (ASMCOD(I),I=1,NINTLD)
11	1-N	NFNLAB	Aero box group definitions ((NFNLAB(I,J),I=1,3),J=1,NABGRP)
12	1-N	PINTP	Integrated load due to aero boxes (((PINTP(I,J,K),I=1,NINTLD),J=1,NABGRP), K=1,NBOXES)
13	1-N	NFNLSB	Slender body element group definitions ((NFNLSB(I,J),I=1,3),J=1,NSBGRP)
14	1-N	PINTZ	Integrated loads due to slender body Z-force (((PINTZ(I,J,K),I=1,NINTLD),J=1,NSBGRP), K=1,NAERSB)
15	1-N	PINTY	Integrated loads due to slender body Y-force (((PINTY(I,J,K),I=1,NINTLD),J=1,NSBGRP), K=1,NAERSB)

TABLE 22

FREQUENCY RESPONSE (FRSP) FILE DESCRIPTION

Record type	Word	Item	Description
1	1	TYPE	data set type(=4HFRSP)
	2	IDENT	identification number
	3	NGUST	number of gust orientations
	4	NFREQ	number of frequencies
	5	NSYM	number of symmetric modes
	6	NASYM	number of antisymmetric modes
	7	NK	number of reduced frequencies used in the interpolations
	8	NTOTAP	number of total aero points
	9-10		not used
	11	VEL	true velocity (ft/sec)
	12	SIGMA	density ratio
2	1-N	CF	gust orientation direction cosines ((CF(I,J),I=1,3),J=1,NGUST)
3	1-N	OMEGA	frequencies (rad/sec) (OMEGA(I),I=1,NFREQ)
Record types 4 thru 9 are repeated for K=1,NFREQ and N=1,NGUST			
4	1	NOR	orientation number
	2	IFREQ	frequency number
	3	FREQ	frequency (HZ)
	4	IZROS	orientation for zero symmetric gust loads
	5	IZROA	orientation for zero antisymmetric gust loads
5	1-N	COEF	interpolation coefficients (COEF(I),I=1,NK)
6	1-N	IVBWI	reduced frequency numbers of aero used for interpolation of this frequency (IVBWI(I),I=1,NK)
7	1-N	Q	complex generalized displacement (Q(I),I=1,NM), where NM=NSYM+NASYM
8	1-N	FGAROS	complex symmetric aerodynamic element gust forces (F(I),I=NTOTAP)
9	1-N	FGAROA	complex antisymmetric aerodynamic element gust forces (F(I),I=1,NTOTAP)

TABLE 23

UNIT GUST LOADS (LOAD) FILE DESCRIPTION

Record type	Word	Item	Description
1	1	TYPE	data set type (=4HLCAD)
	2	IDENT	identification number
	3	NGUST	number of gust orientations
	4	NFREQ	number of frequencies
	5	NINTLD	number of integrated loads
	6	NACC	number of acceleration mass points
	7-10	-	not used
	11	VEL	true velocity (FPS)
	12	SIGMA	density ratio
	13-50		not used
2	1-N	STALDS	Integrated load definitions ((STALDS(I,J),I=1,NINTLD),J=1,8)
3	1-N	CR	gust crientation direction cosines ((CR(I,J),I=1,3),J=1,NGUST)
4	1-N	OMEGA	frequencies (rad/sec) (OMEGA(I),I=1,NFREQ)
Record type 5 is omitted if NACC=0			
5	1-N	INDACC	acceleration mass point and degree of freedom numbers ((INDACC(I,J),I=2,),J=1,NACC)
Record types 6 thru 9 are repeated for K=1,NGUST Record types 6 and 7 are omitted if NACC=0			
6	1-N	AS	complex symmetric accelerations ((AS(I,J),I=1,NACC),J=1,NFREQ)
7	1-N	AA	complex antisymmetric accelerations ((AA(I,J),I=1,NACC),J=1,NFREQ)
8	1-N	PS	complex symmetric integrated loads ((PS(I,J),I=1,NINTLD),J=1,NFREQ)
9	1-N	PA	complex antisymmetric integrated loads ((PA(I,J),I=1,NINTLD),J=1,NFREQ)

TABLE 24

MASS STORAGE FILE DESCRIPTION

Record type	Word	Item	Description
Record types 1 thru 4 are repeated for K=1,NK			
1	1-N	DS	complex generalized forces due to symmetric modes, ((DS(I,J),I=1,NSYM),J=1,NSYM)
2	1-N	DA	complex generalized forces due to antisymmetric modes ((DA(I,J),I=1,NASYM),J=1,NASYM)
Record types 3 and 4 are repeated for N=1,NG			
3	1-N	FS	complex gust forces due to symmetric modes (FS(I),I=1,NTOTAP), where NTOTAP=NBOX+2NSBE
4	1-N	FA	complex gust forces due to antisymmetric modes, (FA(I),I=1,NTOTAP)
5	1-N	SPLHS	aero force integration matrix for symmetric modes ((SPLHS(I,J),I=1,NTOTAP),J=1,NSYM)
6	1-N	SPLHA	aero force integration matrix for antisymmetric modes ((SPLHA(I,J),I=1,NTOTAP),J=1,NASYM)
7	1-N	GEOMBX	AAS coordinates of inboard and outboard edge of 1/4 chord of aero boxes ((GEOMBX(I,J),I=1,NBOX),J=1,6)
8	1-N	GEOMBD	AAS coordinates of leading and trailing edge of slender body elements ((GEOMBD(I,J),I=1,NSBE),J=1,6)

NSYM = number of symmetric modes
NASYM = number of antisymmetric modes
NBOX = number of lifting surface boxes
NSBE = number of slender body elements

TABLE 25

SEGLOAD DIRECTIVE LISTING

```
A1      TREE    GEOM
A2      TREE    SPLINE
SPLINE  INCLUDE SORT
A3      TREE    DOTP
DOTP    INCLUDE ORGN
A4      TREE    GEND
GEND    INCLUDE DPPS,DPZY,DYPZ,DZPY,SUBB,SUBP
A5      TREE    SP
SP      INCLUDE DUMULT,DZYMAT,POWDYZ,MUZYC
A6      TREE    BFSMAT
BFSMAT  INCLUDE FWMW,FZY2
A7      TREE    WANDWT
WANDWT  INCLUDE GUST,RHSIDE,SOLVIT,MATMUL
A8      TREE    GENF
A9      TREE    AERO
A10     TREE    NEWH
A11     TREE    PISTON
M1      TREE    CSDLM-(A1,A2,A3,A4,A5,A6,A7,A8,A9,A10,A11)
CSDLM   INCLUDE SDLM
CSDLM   GLOBAL  KDS,DLM
M2      TREE    INERTM
M3      TREE    ACS
M4      TREE    LOAD-(BEAM,GEOMMB,MSSPHI,GEOMAB,GEOMSB,AFOLOD)
LOAD    INCLUDE TRAERC
M5      TREE    CFREQF
M6      TREE    CFRIOD
M7      TREE    CGUST-(CTRIM,GUSTDR)
GUSTDR  INCLUDE GSTHST
M8      TREE    CRIGID
M9      TREE    CMERGE
MAIN    TREE    DYCGUST-(M1,M2,M3,M4,M5,M6,M7,M8,M9)
        GLOBAL  DISK2,ZZZ,XTF,AEROMX,DCTBLS
        END
```

SECTION VII

EXAMPLE PROBLEM

The sample problem chosen for analyses demonstration consists of a large twin engine transport. The number of degrees of freedom for the model are sufficient for demonstration of the large analyses capability of the program, though fewer aero strips, mass points, integrated loads, and elastic modes were used than necessary for a complete analyses of an aircraft of this size; 116 boxes, 19 slender body elements and 28 masses.

Figure 23 shows the aero node points and aero strips. Figure 24 shows the mass points and beam network used. Figure 25 defines the integrated loads. The modes consisted of nine rigid body modes and trim modes plus 3 symmetric and 4 antisymmetric elastic modes. The elastic modes are simple symmetric and antisymmetric surface flapping modes of the wing and horizontal and vertical tail surfaces and simple in-plane and out-of-plane fuselage hinge modes.

Details of the model data may be found in the sample data input listings and sample run data which are given in Tables 26 and 27 through 30.

Table 27 consists of the printout of a pass through the aerodynamic module for a reduced frequency of zero. Table 28 illustrates the printout of the unit load module. Table 29 is for the Frequency Response and Unit Gust Load Modules. Only selected orientation output has been included for illustrative purposes. Table 30 details the output for a single iteration pass through the trim and blast portion of the program for one orientation. The plotted data are shown for the first iteration only.

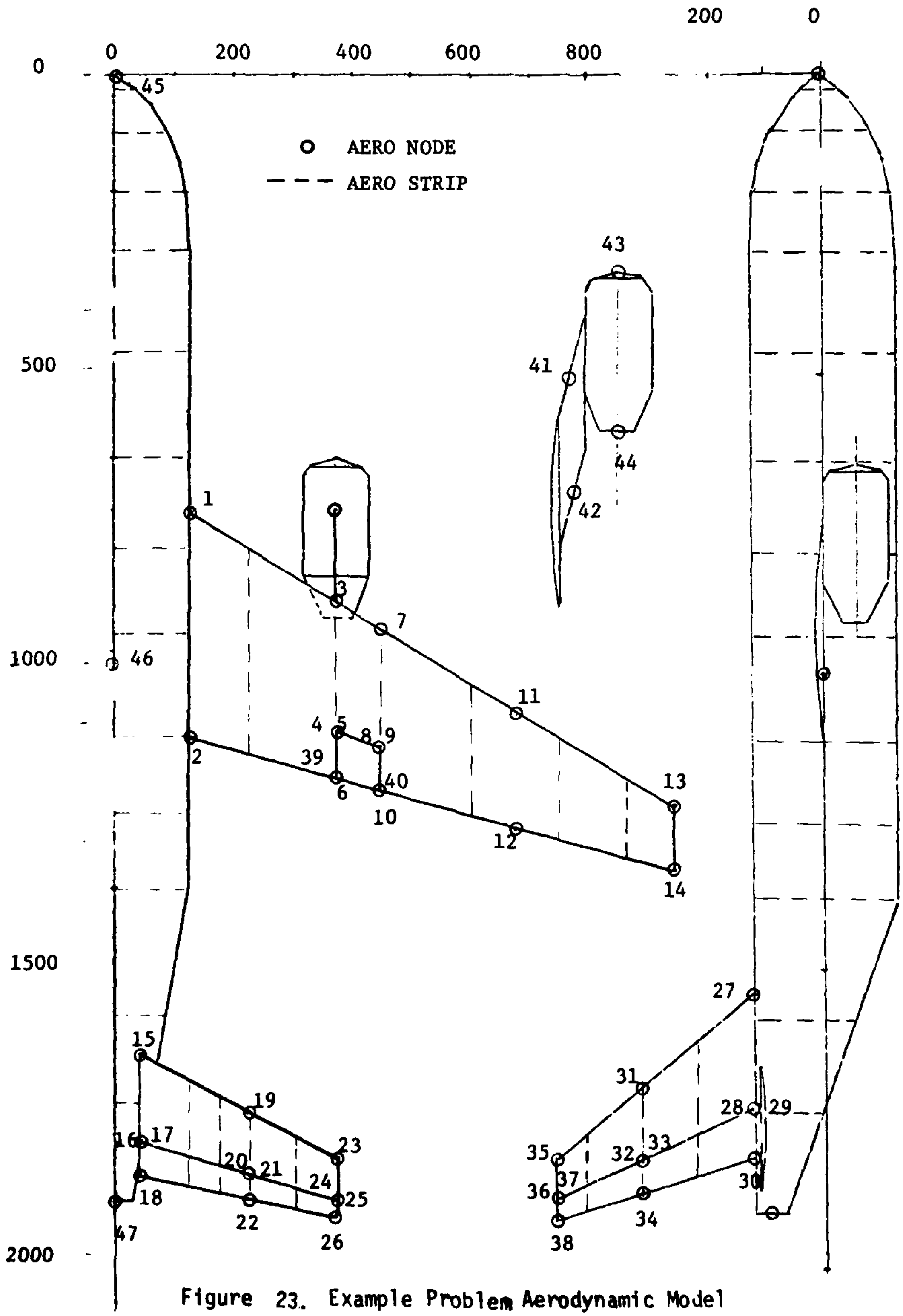

Figure 23. Example Problem Aerodynamic Model

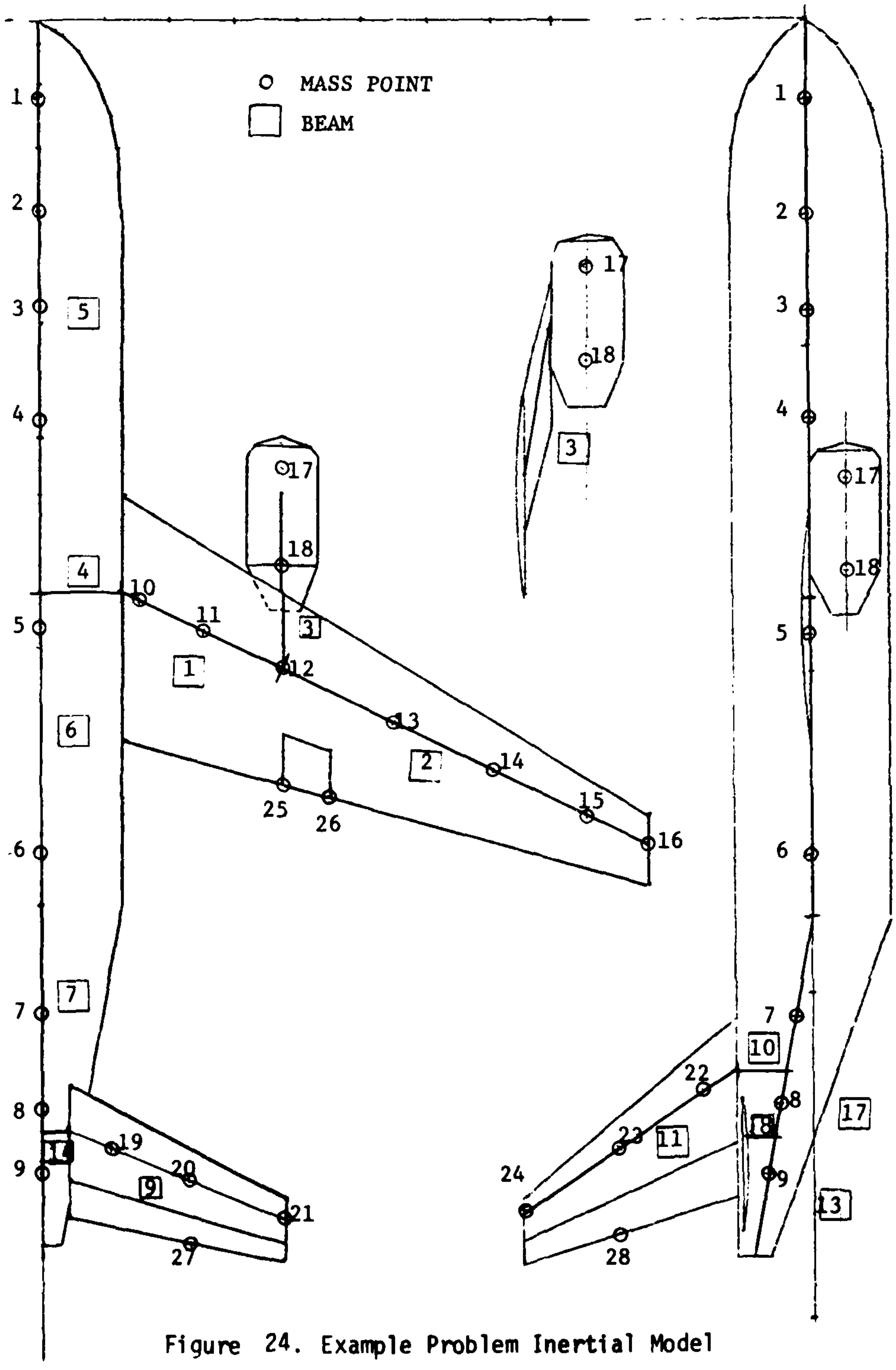

Figure 24. Example Problem Inertial Model

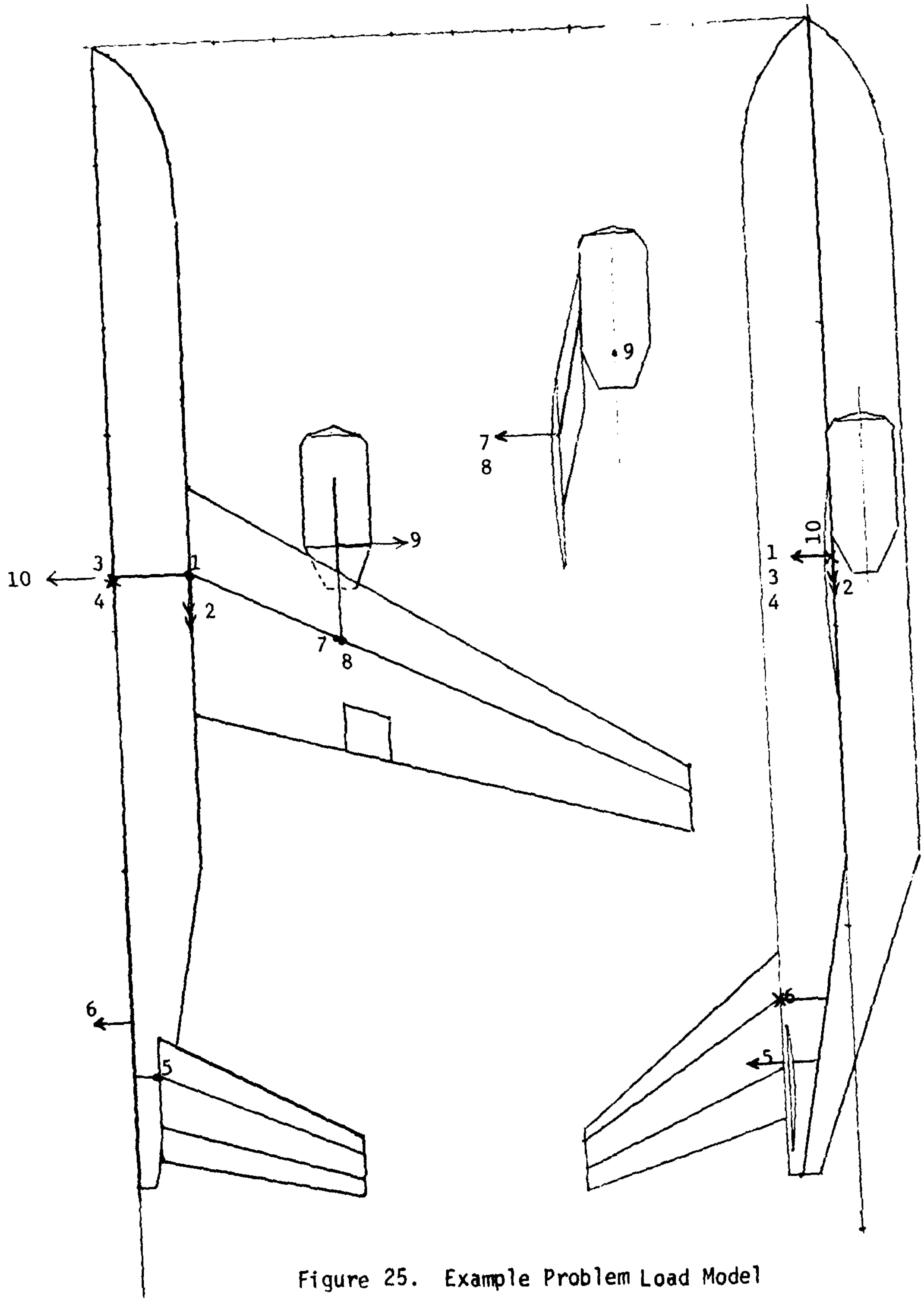

Figure 25. Example Problem Load Model

TABLE 26

EXAMPLE PROBLEM INPUT DATA LISTING

```
*************************************************************************
*****
***** HERE STARTS THE FIXED DATA DECK
*****
*************************************************************************
*****
***** HERE STARTS THE AERODYNAMIC MODULE INPUT DATA
*****
*************************************************************************
*****
***** HERE STARTS THE GENERAL DATA
*****
AERO                                                             ITEM   1
        47         7         0         2         9               ITEM   2
         9        27         8         3       116               ITEM   3
         2        19         8                                   ITEM   4
*****
***** HERE STARTS THE NODAL POINT COORDINATES
*****
  740.       120.       0.                                       ITEM   5
 1120.       120.       0.
  893.61     375.      44.36
 1114.99     375.      44.36
 1114.99     375.      44.36
 1190.66     375.      44.36
  939.8      450.      58.19
 1141.99     450.      58.19
 1141.99     450.      58.19
 1211.45     450.      58.19
 1074.34     675.      97.86
 1273.80     675.      97.86
 1240.0      950.     146.35
 1350.       950.     146.35
 1660.        40.     113.137
 1811.99      40.     113.137
 1811.99      40.     113.137
 1970.        40.     113.137
 1759.40     225.     145.76
 1867.42     225.     145.76
```

```
1867.42        225.          145.76
1908.66        225.          145.76
1840.          375.          172.21
1912.37        375.          172.21
1912.37        375.          172.21
1940.          375.          172.21
1545.            0.0         120.
1728.74          0.0         120.
1728.74          0.0         120.
1920.            0.0         120.
1703.33          0.0         310.
1819.75          0.0         310.
1819.75          0.0         310.
1877.58          0.0         310.
  1820.          0.0         450.
  1886.81        0.0         450.
  1886.81        0.0         450.
  1920.          0.0         450.
1190.66        375.          44.36
1211.45        450.          58.19
 816.81        375.          22.48
  1038.19      375.          22.48
650.           375.          -55.
  920.         375.          -55.
     0.0         0.0          0.0
  1000.          0.0          0.0
  1912.          0.0          0.0
*****
***** HERE STARTS THE MODESHAPES
*****
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
```

ITEM 6

```
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
-0.9848
 0.0
 0.0
 0.0
 0.0
 0.0
 0.0
 0.0
 0.0
 0.0
 0.0
 0.0
 0.0
-.9848
-.9848
 0.0
 0.0
             -1.0          0.0
             -1.0          0.0
             -1.0          0.0
             -1.0          0.0
             -1.0          0.0
 0.2560                                                        ITEM    6
```

-0.1182
0.1048
-0.1132
-0.1132
-0.1878
0.06027
-0.1398
-0.1398
-0.2082
-0.07321
-0.2696
-0.2364
-0.3447
-0.6500
-0.7997
-0.7397
-0.8568
-0.7479
-0.8542
-0.8542
-0.8949
-0.8272
-0.8985
-0.8985
-0.9257
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
-.1878
-.2082

ITEM 6

```
0.0
0.0
        0.350     0.0
        0.080     0.0
        1.0       0.0
        0.0       0.0
       -0.912     0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
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ITEM 6

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-0.055569		
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ITEM 6

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               0.2609      0.055
               0.2609      0.055
               0.0         0.0
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               0.0         0.0                                   ITEM   6
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ITEM 6

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-0.8568
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ITEM 6

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	-1.0	0.0
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	-0.912	0.0
-0.1182		
-0.1182		
-0.3771		
-0.3771		
-0.3771		
-0.3771		
-0.4533		
-0.4533		
-0.4533		
-0.4533		
-0.6817		
-0.6817		
-0.9610		
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-0.06023		
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-0.2481		
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-0.4004		
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-0.3100		
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-0.4500		
-0.4500		
-0.4500		
-0.4500		
-.3771		
-.4533		
-0.02248		
-0.02248		
	-0.375	-0.055
	-0.375	-0.055
	0.0	0.0
	0.0	0.0
	0.0	0.09500
. 4515		
-0.02084		
0.01847		
-0.01997		
-0.01997		
-0.03311		
0.01063		
-0.02466		
-0.02466		
-0.03672		
-0.01291		
-0.04754		
-0.04168		
-0.06078		
-0.1146		
-0.1410		
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-0.1511		
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-0.1584
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-0.1632
-0.5450
-0.7287
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-0.8200
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-0.8197
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-0.8776
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0.0	-0.350
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0.0	0.9120

ITEM 6

-0.1736
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ITEM 6

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-0.052155		
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-0.029933		
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                          0.0          0.0                                          ITEM    5
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ITEM 6

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ITEM 6

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ITEM 6

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                0.0           0.0
                0.0          -0.912
               0             0            0            0                                    ITEM   7
              10             0            0                                                 ITEM   8
 0.85          405700.       950.          300.0        1000.        2.0
 0.0           0.1           0.25          0.5          0.75         1.0                    ITEM  10
 1.25          1.5           1.75          2.0
*****
***** HERE STARTS THE PANEL DATA
*****
 740.          1120.         893.61        1190.66                                          ITEM   1
 120.          375.          0.0           44.96                                            ITEM   2
               8             2            1                                                 ITEM   3
 0.0           0.125         0.25          0.375        0.50         0.622631               ITEM   4
 0.745262      0.872631      1.0
 0.0           0.41175       1.0                                                            ITEM   5
 893.61        1114.99       938.80        1141.99                                          ITEM   1
 375.0         450.          44.96         58.19                                            ITEM   2
               6             1            1                                                 ITEM   3
 0.0           0.1666667     0.3333333     0.50         0.666667     0.833333               ITEM   4
 1.0
 0.0           1.0                                                                          ITEM   5
1114.99        1190.65       1141.99       1211.45                                          ITEM   1
 375.          450.          44.96         58.19                                            ITEM   2
               2             1            1                                                 ITEM   3
 0.0           0.50          1.00                                                           ITEM   4
 0.0           1.0                                                                          ITEM   5
938.80         1211.45       1240.         1350.                                            ITEM   1
450.           950.          58.19         146.35                                           ITEM   2
               8             4            1                                                 ITEM   3
 0.0           0.125         0.25          0.375        0.50         0.622631               ITEM   4
 0.745262      0.872631      1.0
 0.0           0.30          0.60          0.85         1.0                                 ITEM   5
 1660.         1811.99       1840.0        1912.37                                          ITEM   1
 40.0          375.0         113.137       172.21                                           ITEM   2
               4             5            2                                                 ITEM   3
 0.0           0.25          0.50          0.75         1.00                                ITEM   4
 0.0           0.23881       0.403         0.55224      0.77612      1.0                    ITEM   5
 1811.99       1870.0        1912.37       1940.0                                           ITEM   1
```

```
 40.0          375.0          113.137        172.21                                          ITEM  2
              2              5              2                                                ITEM  3
 0.0           0.50           1.00                                                           ITEM  4
  0.0          0.23881        0.403          0.55224        0.77612       1.0                ITEM  5
1545.0         1728.74        1920.          1886.81                                         ITEM  1
 0.0           0.0            120.           450.                                            ITEM  2
              4              4              3                                                ITEM  3
 0.0           0.25           0.50           0.75           1.00                             ITEM  4
  0.0          0.27273        0.57576        0.87879        1.0                              ITEM  5
1728.74        1820.          1885.81        1920.                                           ITEM  1
 0.0           0.0            120.           450.                                            ITEM  2
              2              4              3                                                ITEM  3
 0.0           0.50           1.0                                                            ITEM  4
 0.0           0.27273        0.57576        0.87879        1.0                              ITEM  5
 740.          961.38         893.61         1114.99                                         ITEM  1
 375.          375.           0.             44.96                                           ITEM  2
              6              1              1                                                ITEM  3
 0.0           0.167727       0.335453       0.503179       0.670905      0.835453           ITEM  4
 1.0
 0.            1.                                                                            ITEM  5
*****
***** HERE STARTS THE BODY DATA
*****
 0.0           0.0            120.0          1.0                                             ITEM  1
              4             14              0              1             4                   ITEM  2
 650.0         800.0          950.0          1120.0         1250.0                           ITEM  3
 45.0          135.0          225.0          315.0                                           ITEM  5
 0.0           25.0           100.0          200.0          300.0         475.0              ITEM  6
 650.0         800.0          950.0          1120.0         1250.0        1380.0
 1600.0        1750.0         1912.0
 0.0           35.0           70.0           90.0           100.0         110.0              ITEM  7
 120.0         120.0          120.0          120.0          120.0         120.0
 85.0          60.0           0.0
-55.           375.           55.            1.                                              ITEM  1
              4              5              0              1             4                   ITEM  2
 740.          814.263        888.525        961.38         1115.                            ITEM  3
 45.           135.           225.           315.                                            ITEM  5
 650.          560.           680.           765.           850.          920.               ITEM  6
 0.            45.            55.            55.            55.           25.                ITEM  7
```

```
*****
***** HERE STARTS THE MODAL SPLINE INTERPOLATION DATA
*****
         2          7         12          0                         ITEM   1
         1          3          1          0                         ITEM   2
         1                                                          ITEM   3
        45         46         47                                    ITEM   4
         1          2          1                                    ITEM   2
         2                                                          ITEM   3
        43         44                                               ITEM   4
         0         12          3          0                         ITEM   2
         1          2          4                                    ITEM   3
         1          2          3          4         39         7    ITEM   4
         8         40         11         12         13        14
         0          4          1          0                         ITEM   2
         3                                                          ITEM   3
         5          6          9         10                         ITEM   4
         0          6          1          0                         ITEM   2
         5                                                          ITEM   3
        15         16         19         20         23        24    ITEM   4
         0          6          1          0                         ITEM   2
         6                                                          ITEM   3
        17         18         21         22         25        26    ITEM   4
         0          6          1          0                         ITEM   2
         7                                                          ITEM   3
        27         28         31         32         35        36    ITEM   4
         0          6          1          0                         ITEM   2
         8                                                          ITEM   3
        29         30         33         34         37        38    ITEM   4
                    2          1                                    ITEM   2
         9                                                          ITEM   3
        41         42                                               ITEM   4
*****
***************************************************************************
*****
***** HERE STARTS THE INERTIAL MODULE INPUT DATA
*****
***************************************************************************
*****
```

```
IMOD                                                                              ITEM   1
        28              1              0                                          ITEM   2
*****
***** HERE STARTS THE MASS AND LOCATION DATA
*****
  23.533       120.0                                                              ITEM   3
 27.035        300.0
 24.575        450.0
 36.453        625.0
 113.912       950.0
 67.202        1300.0
 27.931        1550.0
 16.416        1700.0
 17.058        1800.0
  23.155       904.24        150.0         5.29
  41.680       951.71        250.0         22.92
  29.542       1011.05       375.0         44.96
  13.528       1094.12       550.0         75.92
  14.028       1155.33       700.0         102.27
   5.020       1236.53       850.0         128.72
   0.329       1284.0        950.0         146.35
 20.721        700.0         375.0        -55.0
  11.655       850.0         375.0        -55.0
   6.309       1751.07       100.0         123.72
   3.989       1813.31       225.0         145.76
   0.570       1876.0        375.0         172.21
   3.859       1673.17       0.0           175.0
 2.202         1755.35       0.0           310.0
   0.642       1854.0        0.0           450.0
 0.196         1190.65       375.          44.96
 0.196         1211.45       450.          58.19
 1.03          1908.65       225.          145.76
 1.48          1877.58       0.            310.
*****
***** HERE STARTS THE INERTIAL MODAL FREQUENCIES AND MODESHAPES
*****
 0.0                                                                              ITEM   4
 0.0           0.0          -1.0
 0.0           0.0          -1.0
```

ITEM 4

0.0	0.0	-1.0
0.0	0.0	-1.0
0.0	0.0	-1.0
0.0	0.0	-1.0
0.0	0.0	-1.0
0.0	0.0	-1.0
0.0	0.0	-1.0
0.07354	-0.1573	-0.9848
0.07354	-0.1573	-0.9848
0.07354	-0.1573	-0.9848
0.07354	-0.1573	-0.9848
0.07354	-0.1573	-0.9848
0.07354	-0.1573	-0.9848
0.07354	-0.1573	-0.9848
0.0	0.0	-1.0
0.0	0.0	-1.0
0.06609	-0.1606	-0.9848
0.06609	-0.1606	-0.9848
0.06609	-0.1606	-0.9848
0.5494	0.0	-0.8355
0.5494	0.0	-0.8355
0.5494	0.0	-0.8355
0.07354	-0.1573	-0.9848
0.07354	-0.1573	-0.9848
0.06609	-0.1606	-0.9848
0.5494	0.0	-0.8355
0.0		
0.0	0.0	0.8800
0.0	0.0	0.7000
0.0	0.0	0.5500
0.0	0.0	0.3750
0.0	0.0	0.0500
0.0	0.0	-0.3000
0.03	0.0	-0.5500
0.057	0.0	-0.7000
0.075	0.0	-0.8000
-0.00225	0.0173	0.09431
0.01721	0.0173	0.04756
0.04154	0.0173	-0.01088

ITEM 4

0.07561	0.0173	-0.09269
0.1048	0.0173	-0.1628
0.1340	0.0173	-0.2329
0.1535	0.0173	-0.2797
-0.055	0.0	0.3000
-0.055	0.0	0.1500
0.1648	-0.07509	-0.7495
0.1885	-0.07513	-0.8010
0.2171	-0.07513	-0.8627
0.5161	0.0	-0.4563
0.6657	0.0	-0.4663
0.8452	0.0	-0.4563
0.05475	-0.01095	-0.1978
0.06826	-0.008619	-0.2082
0.1948	-0.09044	-0.8949
0.7412	0.0	-0.5529
0.0		
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-0.9059	-0.4235	0.0
-0.9059	-0.4235	0.0
-0.9059	-0.4235	0.0
-0.9059	-0.4235	0.0
-0.9059	-0.4235	0.0
-0.9059	-0.4235	0.0
-0.9059	-0.4235	0.0
-1.0	0.0	0.0
-1.0	0.0	0.0
-0.9247	-0.3805	0.0
-0.9247	-0.3806	0.0
-0.9247	-0.3805	0.0
-0.8355	0.0	-0.5494

-0.8355	0.0	-0.5494	
-0.8355	0.0	-0.5494	
-0.9059	-0.4235	0.0	
-0.9059	-0.4235	0.0	
-0.9247	-0.3806	0.0	
-0.8355	0.0	-0.5494	
10.0			ITEM 4
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0.0			
0.0			
0.0			
0.0			
0.0			
0.0			
0.0			
0.0			
0.0			
0.0			
0.0			
0.0			
		-0.039505	
0.0			
2.0			ITEM 4
0.0	0.0	0.0	
0.0	0.0	0.0	
0.0	0.0	0.0	

ITEM 4

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
		0.0305
		0.1320
		0.2589
		0.4366
		0.5889
		0.7413
		0.8428
	0.055	0.2609
	0.055	0.2609
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
		0.2589
		0.3351
0.0	0.0	0.0
0.0	0.0	0.0
4.0		
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0

ITEM 4

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
		0.0609
		0.1879
		0.3402
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
		0.1879
0.0	0.0	0.0
0.0		
0.0	0.0	-0.880
0.0	0.0	-0.700
0.0	0.0	-0.550
0.0	0.0	-0.375
0.0	0.0	-0.050
		-0.300
		-0.550
		-0.700
		-0.800
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.1711	-0.0752	-0.7495
0.1949	-0.0752	-0.8010
0.2235	-0.0752	-0.8627
0.5161	0.0	-0.4563
0.6657	0.0	-0.4563

0.8452	0.0	-0.4663	
0.0	0.0	0.0	
0.0	0.0	0.0	
0.	0.	-0.8949	
0.0	0.0	0.0	
0.0			ITEM 4
0.0	0.0	0.0	
0.0	0.0	0.0	
0.0	0.0	0.0	
0.0	0.0	0.0	
0.0	0.0	0.0	
0.0	0.0	0.0	
0.0	0.03	0.0	
0.0	0.057	0.0	
0.0	0.075	0.0	
0.008825	-0.01883	-0.1486	
0.008825	-0.01888	-0.2502	
0.008825	-0.01883	-0.3771	
0.008825	-0.01888	-0.5548	
0.008825	-0.01883	-0.7071	
0.008825	-0.01888	-0.8594	
0.008825	-0.01888	-0.9510	
0.0	-0.055	-0.3750	
0.0	-0.055	-0.3750	
-0.03980	0.0967	-0.1200	
-0.03976	0.09661	-0.2469	
-0.03976	0.09661	-0.3992	
0.0	0.1750	0.0	
0.0	0.3000	0.0	
0.0	0.4500	0.0	
0.008826	-0.01883	-0.3771	
0.008824	-0.01887	-0.4533	
-0.03976	0.09661	-0.2469	
0.0	0.310	0.0	
0.0			ITEM 4
0.0	-0.8800	0.0	
0.0	-0.7000	0.0	
0.0	-0.5500	0.0	
0.0	-0.3750	0.0	

ITEM 4

0.0	-0.0500	0.0
0.0	0.3000	0.0
0.0	0.5500	0.0
0.0	0.7000	0.0
0.0	0.8000	0.0
-0.09595	-0.1490	0.01663
-0.2063	-0.1490	0.008385
-0.3443	-0.1490	-0.001919
-0.5375	-0.1490	-0.01634
-0.7031	-0.1490	-0.02871
-0.8687	-0.1490	-0.04107
-0.9790	-0.1490	-0.04932
-0.375	-0.3000	0.0
-0.375	-0.1500	0.0
-0.3777	0.6550	-0.1322
-0.5129	0.6550	-0.1412
-0.6751	0.6550	-0.1521
0.0	0.6732	0.0
0.0	0.7554	0.0
0.0	0.8540	0.0
-0.4192	0.01123	-0.03311
-0.4958	-0.001931	-0.03672
-0.5486	0.7419	-0.1578
0.0	0.8776	0.0
0.0		
0.0	1.0	0.0
0.0	1.0	0.0
0.0	1.0	0.0
0.0	1.0	0.0
0.0	1.0	0.0
0.0	1.0	0.0
0.0	1.0	0.0
0.0	1.0	0.0
0.0	1.0	0.0
-0.4171	0.8921	-0.1736
-0.4171	0.8921	-0.1736
-0.4171	0.8921	-0.1736
-0.4171	0.8921	-0.1736
-0.4171	0.8921	-0.1736

-0.4171	0.3921	-0.1736
-0.4171	0.3921	-0.1736
0.0	1.0	0.0
0.0	1.0	0.0
-0.3748	0.9107	-0.1736
-0.3748	0.9107	-0.1736
-0.3748	0.9107	-0.1736
0.0	1.0	0.0
0.0	1.0	0.0
0.0	1.0	0.0
-0.4171	0.3921	-0.1736
-0.4171	0.3921	-0.1736
-0.3748	0.9107	-0.1736
0.0	1.0	0.0
10.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		
0.0		

ITEM 4

```
0.0
0.0
0.0
                0.052155
10.0                                                      ITEM    4
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
                          -0.071197
                          -0.065354
0.0
0.0
2.0
0.0          0.0          0.0                         ITEM    4
0.0          0.0          0.0
0.0          0.0          0.0
0.0          0.0          0.0
0.0          0.0          0.0
```

ITEM 4

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
		0.0305
		0.1320
		0.2589
		0.4366
		0.5889
		0.7413
		0.8428
	0.055	0.2509
	0.055	0.2509
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
		0.2589
		0.3351
0.0	0.0	0.0
0.0	0.0	0.0
4.0		
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0

ITEM 4

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
		0.0609
		0.1879
		0.3402
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
		0.1879
0.0	0.0	0.0
4.0		
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
	0.0550	
	0.1800	
	0.3300	
0.0	0.0	0.0

```
0.0          0.0          0.0
0.0          0.0          0.0
             0.1300                                                         ITEM   4
2.5
 0.0         -0.980        0.0
 0.0         -0.700        0.0
 0.0         -0.550        0.0
 0.0         -0.375        0.0
 0.0         -0.050        0.0
             -0.300
             -0.550
             -0.700
             -0.800
0.0          0.0          0.0
0.0          0.0          0.0
0.0          0.0          0.0
0.0          0.0          0.0
0.0          0.0          0.0
0.0          0.0          0.0
0.0          0.0          0.0
0.0          0.0          0.0
0.0          0.0          0.0
 0.3777      -0.6550       0.1322
 0.5129      -0.6550       0.1412
 0.6751      -0.6550       0.1521
 0.0         -0.6732
 0.0         -0.7554
 0.0         -0.854
0.0          0.0          0.0
0.0          0.0          0.0
0.0          0.0          0.0
 0.          -0.3776
*****
***** HERE STARTS THE MODAL DEFINITIONS, AMOUNG
*****
             1            2            3            5            7           ITEM   5
             4            0            0            0            0
             8            9           10           13           16
            12           11            0            0            0
```

```
*****
***** HERE STARTS THE MODAL STRUCTURAL DAMPING, CPXDPG
*****
0.0         0.0         0.0         0.03        0.03        0.03        ITEM   6
0.03        0.          0.          0.          0.03        0.03
0.03        0.03        0.03        0.03
*****
*****************************************************************************
*****
***** HERE STARTS THE UNIT LOAD MODULE DATA
*****
*****************************************************************************
*****
LOAD                                                                    ITEM   1
            14          10          0           13          5         61ITEM   2
*****
***** HERE STARTS THE BEAM GEOMETRY, BEAMGM
*****
890.        120.        0.                                              ITEM   3
1011.05     375.0       44.96       1.0
1011.05     375.        44.96                                           ITEM   3
1284.0      950.0       146.35      1.0
1011.05     375.0       44.96                                           ITEM   3
800.0       375.0       0.          4.0
890.0       0.          0.
890.0       120.0       0.          1.0
890.0       0.          0.
0.0         0.          0.          2.0
890.        0.          0.
1380.0      0.          0.          2.0
1380.0      0.          0.
1637.0      0.          45.89       2.0
1736.0      0.          63.57
1736.0      0.          113.14      1.0
1736.0      40.0        113.14
1876.0      375.0       172.21      1.0
1637.0      0.          45.89
1637.0      0.          120.0       3.0
1637.0      0.          120.
```

```
1854.0     0.         450.0      3.0
1637.0     0.         45.89
1736.0     0.         63.57      2.0
1736.0     0.         63.57
1912.0     0.         95.0       2.0
1736.0     0.         113.14
1736.0     40.0       113.14     1.0
*****
***** HERE STARTS THE REQUIRED INTEGRATED LOADS, STALOS
*****
4.0        4.0        1.0                                          ITEM    4
 890.0      120.0      0.          100000.0   -100000.0
4.0        1.0        1.0                                          ITEM    4
 890.0      120.0      0.0         1.718    +10-1.446    +10
5.0        6.0        2.0                                          ITEM    4
 890.0      0.0        0.0         7500.       -7500.
6.0        6.          2.0
 890.0      0.0        0.0         1.5      E05-1.5      E05
14.0       4.         1.0
 1736.0     40.0       113.14      80000.0    -80000.0
10.0       4.         3.0
 1637.0     0.         120.0       7500.      -7500.
1.0        4.         1.0
 1011.05    375.0      44.96        50000.0   - 50000.0
2.0        4.         1.0
 1011.05    375.0      44.96       100000.0   -100000.0
3.0        4.         4.0
 850.       375.       -55.        1.       E06-1.       E06
6.0        4.         2.0
 890.       0.         0.          1.       E10-1.       E10
*****
***** MATRIX DEFINING LOCAL STRESSES, STRESS, OMITTED SINCE NSTRSS=0
*****
*****
***** HERE STARTS THE DEFINITIONS OF GROUPS OF MASSES, NFNLMB
*****
           1          4          5                                 ITEM    5
           5          5          6
           7          7          7
```

```
          8          8          12
          9          9          13
         10         12           1
         13         15           2
         17         18           3
         19         21           9
         22         24          11
         25         25           2
         27         27           9
         29         28          11
*****
***** HERE STARTS THE DIRECTION COSINE MATRICES, TLAMV
*****                                                            ITEM   7
1.0
           1.0
                      1.0
1.0                                                              ITEM   7
           1.0
                      1.0
1.0                                                              ITEM   7
           1.0
                      1.0
1.0                                                              ITEM   7
           1.0
                      1.0
1.0                                                              ITEM   7
           1.0
                      1.0
0.9059     0.4235                                                ITEM   7
 -0.4171    0.8921    -0.1736
-.0735     0.1573     0.9848
0.9059     0.4235                                                ITEM   7
-0.4171     0.8921    -0.1736
-0.0735    0.1573     0.9848
1.0                                                              ITEM   7
           1.0
                      1.0
0.9247     0.3806                                                ITEM   7
 -0.3748    0.9107    -0.1736
```

```
-0.0661     0.1506      0.9848                                   ITEM  7
0.8355                  0.5494
            1.0
-0.5494                 0.8355                                   ITEM  7
0.9059      0.4235
 -0.4171     0.8921     -0.1736
-.0735      0.1573      0.9848                                   ITEM  7
0.9247      0.3305
 -0.3748     0.9107     -0.1736
-0.0661     0.1506      0.9848                                   ITEM  7
0.8355                  0.5494
            1.0
-0.5494                 0.8355
*****
***** HERE STARTS THE DEFINITION OF GROUPS OF AERO BOXES, NENLAB
*****                                                            ITEM  8
         1           15          1
        17           55          2
        57           85          9
        87          110         11
       111          116          3
*****
***** HERE STARTS THE DEFINITION OF GROUPS OF SLENDER BODY ELEMENTS, NENLSB
*****                                                            ITEM  9
         1            9          5
         9           11          6
        12           12          7
        13           13         12
        14           14         13
        15           19          3
*****
***** HERE STARTS THE DEFINITION OF ENGINE MASS POINTS, NENGM
*****                                                            ITEM 10
        17           18
```

```
*****
********************************************************************************
*****
***** HERE STARTS THE RUN DATA DECK
*****
********************************************************************************
*****
          6          0          0                                        G1   I1
FRSP     GUST      BLST                                                  G1   I2
 1000.0     552.15     1.0                  2.0                          G1   I3
          4          0          0                                        G3   I1
 0.05       0.95       0.05                                              G3   I2
 1.0        3.0        0.20                                              G3   I2
 3.1        5.0        0.10                                              G3   I2
 5.2        24.0       0.20                                              G3   I2
          0                                                               G4   I1
 1.0        0.0        0.0        0.0       1000.                         G5   I1
 1.0        0.002      10.0       0.0       0.0        3.0                G5   I2
          4          0          1          1          0          0        G5   I3
 10000.                                                                   G5   I4
          5          6          7          8                              G5   I5
 10000.     10000.     10000.     10000.    10000.     10000.             G5   I6
 0.50     E06-0.50    E06                                                 G5   I7
 0.22     E09-0.20    E09                                                 G5   I7
 0.20     E07-0.20    E07                                                 G5   I7
 0.20     E07-0.20    E07                                                 G5   I7
 0.80     E05-0.80    E05                                                 G5   I7
 0.50     E05-0.50    E05                                                 G5   I7
0.20      E06-0.20    E06                                                 G5   I7
0.20      E06-0.20    E06                                                 G5   I7
 1.       E06-1.      E06                                                 G5   I7
 1.       E10-1.      E10                                                 G5   I7
```

TABLE 27

EXAMPLE PROBLEM OUTPUT LISTING

AERODYNAMIC MODULE

```
                                                      DATE
                                                      TIME

FIXED DATA DECK INPUT GO

IDENTS

THE FOLLOWING ANALYSIS CODES HAVE BEEN CALLED FOR IN THIS RUN

AERO
```

DATE
TIME

NODE	ELXI(I)	ELYI(I)	ELZI(I)
1	.740000E+03	.120000E+03	0.
2	.112000E+04	.120000E+03	0.
3	.893610E+03	.375000E+03	.449600E+02
4	.111499E+04	.375000E+03	.449600E+02
5	.111499E+04	.375000E+03	.449600E+02
6	.119066E+04	.375000E+03	.449600E+02
7	.938800E+03	.450000E+03	.581900E+02
8	.114199E+04	.450000E+03	.581900E+02
9	.114199E+04	.450000E+03	.581900E+02
10	.121145E+04	.450000E+03	.581900E+02
11	.107434E+04	.675000E+03	.978600E+02
12	.127393E+04	.675000E+03	.978600E+02
13	.124000E+04	.950000E+03	.146350E+03
14	.135000E+04	.950000E+03	.146350E+03
15	.186000E+04	.400000E+02	.113137E+03
16	.181199E+04	.400000E+02	.113137E+03
17	.181199E+04	.400000E+02	.113137E+03
18	.187000E+04	.400000E+02	.113137E+03
19	.175960E+04	.225000E+03	.145760E+03
20	.186742E+04	.225000E+03	.145760E+03
21	.186742E+04	.225000E+03	.145760E+03
22	.197860E+04	.225000E+03	.145760E+03
23	.184000E+04	.375000E+03	.172210E+03
24	.191237E+04	.375000E+03	.172210E+03
25	.191237E+04	.375000E+03	.172210E+03
26	.194000E+04	.375000E+03	.172210E+03
27	.154500E+04	0.	.120000E+03
28	.172874E+04	0.	.120000E+03
29	.172874E+04	0.	.120000E+03
30	.182000E+04	0.	.120000E+03
31	.170333E+04	0.	.310000E+03
32	.181975E+04	0.	.310000E+03
33	.181975E+04	0.	.310000E+03
34	.187756E+04	0.	.310000E+03
35	.182000E+04	0.	.450000E+03
36	.188681E+04	0.	.450000E+03
37	.188681E+04	0.	.450000E+03
38	.192000E+04	0.	.450000E+03
39	.119066E+04	.375000E+03	.449600E+02
40	.121145E+04	.450000E+03	.581900E+02
41	.816810E+03	.375000E+03	.224800E+02
42	.103819E+04	.375000E+03	.224800E+02
43	.650000E+03	.375000E+03	-.550000E+02
44	.920000E+03	.375000E+03	-.550000E+02
45	0.	0.	0.
46	.100000E+04	0.	0.
47	.101200E+04	0.	0.

DATE
TIME

NODE	PHIN(I, 1)	PHII(I, 1)	PHIV(I, 1)
1	-.984800E+00	-0.	-0.
2	-.984800E+00	-0.	-0.
3	-.984800E+00	-0.	-0.
4	-.984800E+00	-0.	-0.
5	-.984800E+00	-0.	-0.
6	-.984800E+00	-0.	-0.
7	-.984800E+00	-0.	-0.
8	-.984800E+00	-0.	-0.
9	-.984800E+00	-0.	-0.
10	-.984800E+00	-0.	-0.
11	-.984800E+00	-0.	-0.
12	-.984800E+00	-0.	-0.
13	-.984800E+00	-0.	-0.
14	-.984800E+00	-0.	-0.
15	-.984800E+00	-0.	-0.
16	-.984800E+00	-0.	-0.
17	-.984800E+00	-0.	-0.
18	-.984800E+00	-0.	-0.
19	-.984800E+00	-0.	-0.
20	-.984800E+00	-0.	-0.
21	-.984800E+00	-0.	-0.
22	-.984800E+00	-0.	-0.
23	-.984800E+00	-0.	-0.
24	-.984800E+00	-0.	-0.
25	-.984800E+00	-0.	-0.
26	-.984800E+00	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	0.	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	0.	-0.	-0.
39	-.984800E+00	-0.	-0.
40	-.984800E+00	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	-.100000E+01	0.
44	-0.	-.100000E+01	0.
45	-0.	-.100000E+01	0.
46	-0.	-.100000E+01	0.
47	-0.	-.100000E+01	0.

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NODE	PHIX(I, 2)	PHIZ(I, 2)	PHIY(I, 2)
1	.254000E+00	-0.	-0.
2	-.118200E+01	-0.	-0.
3	.104800E+01	-0.	-0.
4	-.115200E+00	-0.	-0.
5	-.113200E+00	-0.	-0.
6	-.197800E+00	-0.	-0.
7	.612700E-01	-0.	-0.
8	-.133800E+00	-0.	-0.
9	-.139600E+00	-0.	-0.
10	-.284200E+00	-0.	-0.
11	-.732100E-01	-0.	-0.
12	-.249600E+00	-0.	-0.
13	-.236400E+00	-0.	-0.
14	-.344700E+00	-0.	-0.
15	-.851000E+00	-0.	-0.
16	-.799700E+00	-0.	-0.
17	-.799700E+00	-0.	-0.
18	-.858800E+00	-0.	-0.
19	-.747900E+00	-0.	-0.
20	-.894200E+00	-0.	-0.
21	-.854200E+00	-0.	-0.
22	-.804900E+00	-0.	-0.
23	-.827200E+00	-0.	-0.
24	-.898500E+00	-0.	-0.
25	-.898500E+00	-0.	-0.
26	-.925700E+00	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	0.	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	0.	-0.	-0.
39	-.187800E+00	-0.	-0.
40	-.208200E+00	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	.350000E+00	0.
44	-0.	.800000E-01	0.
45	-0.	.100000E+01	0.
46	-0.	0.	0.
47	-0.	-.912000E+00	0.

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NODE	PHIX(I, 3)	PHIZ(I, 3)	PHIY(I, 3)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	0.	-0.	-0.
20	0.	-0.	-0.
21	0.	-0.	-0.
22	0.	-0.	-0.
23	0.	-0.	-0.
24	0.	-0.	-0.
25	0.	-0.	-0.
26	0.	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	0.	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	0.	-0.	-0.
39	0.	-0.	-0.
40	0.	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	0.	0.
44	-0.	0.	0.
45	-0.	0.	0.
46	-0.	0.	0.
47	-0.	0.	0.

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NODE	PHIN(I, 4)	PHIZ(I, 4)	PHIY(I, 4)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	-.555690E-01	-0.	-0.
19	0.	-0.	-0.
20	0.	-0.	-0.
21	0.	-0.	-0.
22	-.394050E-01	-0.	-0.
23	0.	-0.	-0.
24	0.	-0.	-0.
25	0.	-0.	-0.
26	-.264870E-01	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	0.	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	0.	-0.	-0.
39	0.	-0.	-0.
40	0.	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	0.	0.
44	-0.	0.	0.
45	-0.	0.	0.
46	-0.	0.	0.
47	-0.	0.	0.

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NODE	PHIN(1, 5)	PHIX(1, 5)	PHIY(1, 5)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	[illegible]	-0.	-0.
4	[illegible]	-0.	-0.
5	[illegible]	-0.	-0.
6	[illegible]	-0.	-0.
7	[illegible]	-0.	-0.
8	[illegible]	-0.	-0.
9	[illegible]	-0.	-0.
10	[illegible]	-0.	-0.
11	[illegible]	-0.	-0.
12	[illegible]	-0.	-0.
13	[illegible]	-0.	-0.
14	[illegible]	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	0.	-0.	-0.
20	0.	-0.	-0.
21	0.	-0.	-0.
22	0.	-0.	-0.
23	0.	-0.	-0.
24	0.	-0.	-0.
25	0.	-0.	-0.
26	0.	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	0.	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	0.	-0.	-0.
39	[illegible]	-0.	-0.
40	[illegible]	-0.	-0.
41	[illegible]	-0.	-0.
42	[illegible]	-0.	-0.
43	-0.	.260900E+00	.550000E-01
44	-0.	.260900E+00	.550000E-01
45	-0.	0.	0.
46	-0.	0.	0.
47	-0.	0.	0.

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NODE	PHIN(I, 6)	PHIZ(I, 6)	PHIY(I, 6)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	.187900E+00	-0.	-0.
20	.187900E+00	-0.	-0.
21	.187900E+00	-0.	-0.
22	.187900E+00	-0.	-0.
23	.340200E+00	-0.	-0.
24	.340200E+00	-0.	-0.
25	.340200E+00	-0.	-0.
26	.340200E+00	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	0.	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	0.	-0.	-0.
39	0.	-0.	-0.
40	0.	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	0.	0.
44	-0.	0.	0.
45	-0.	0.	0.
46	-0.	0.	0.
47	-0.	0.	0.

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NODE	PHIN(I, 7)	PHIZ(I, 7)	PHIY(I, 7)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	-.65[illegible]E+00	-0.	-0.
16	-.79579[illegible]E+00	-0.	-0.
17	-.7917[illegible]E+00	-0.	-0.
18	-.856800E+00	-0.	-0.
19	-.747900E+00	-0.	-0.
20	-.854200E+00	-0.	-0.
21	-.854200E+00	-0.	-0.
22	-.864900E+00	-0.	-0.
23	-.827200E+00	-0.	-0.
24	-.898900E+00	-0.	-0.
25	-.898500E+00	-0.	-0.
26	-.925700E+00	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	0.	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	0.	-0.	-0.
39	0.	-0.	-0.
40	0.	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	0.	0.
44	-0.	0.	0.
45	0.	-.100000E+01	0.
46	-0.	0.	0.
47	-0.	-.912000E+00	0.

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NODE	FHIX(I, 8)	PHIZ(I, 8)	PHIY(I, 8)
1	-.118200E+00	-0.	-0.
2	-.118200E+00	-0.	-0.
3	-.377100E+00	-0.	-0.
4	-.377100E+00	-0.	-0.
5	-.377100E+00	-0.	-0.
6	-.377100E+00	-0.	-0.
7	-.453300E+00	-0.	-0.
8	-.453300E+00	-0.	-0.
9	-.453300E+00	-0.	-0.
10	-.453300E+00	-0.	-0.
11	-.681700E+00	-0.	-0.
12	-.681700E+00	-0.	-0.
13	-.961700E+00	-0.	-0.
14	-.961700E+00	-0.	-0.
15	-.602300E-01	-0.	-0.
16	-.602300E-01	-0.	-0.
17	-.602300E-01	-0.	-0.
18	-.602300E-01	-0.	-0.
19	-.248100E+00	-0.	-0.
20	-.248100E+00	-0.	-0.
21	-.248100E+00	-0.	-0.
22	-.248100E+00	-0.	-0.
23	-.400400E+00	-0.	-0.
24	[illegible]	-0.	-0.
25	[illegible]	-0.	-0.
26	-.400400E+00	-0.	-0.
27	-.122000E+00	-0.	-0.
28	-.122000E+00	-0.	-0.
29	-.122000E+00	-0.	-0.
30	-.122000E+00	-0.	-0.
31	-.310000E+00	-0.	-0.
32	-.310000E+00	-0.	-0.
33	-.310000E+00	-0.	-0.
34	-.310000E+00	-0.	-0.
35	-.450000E+00	-0.	-0.
36	-.450000E+00	-0.	-0.
37	-.450000E+00	-0.	-0.
38	-.450000E+00	-0.	-0.
39	-.377100E+00	-0.	-0.
40	-.453300E+00	-0.	-0.
41	-.224800E-01	-0.	-0.
42	-.224800E-01	-0.	-0.
43	-0.	-.375000E+00	-.550000E-01
44	-0.	-.375000E+00	-.550000E-01
45	-0.	0.	0.
46	-0.	0.	0.
47	-0.	0.	.950000E-01

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NODE	PHIN(I, 9)	PHIZ(I, 9)	PHIY(I, 9)
1	.451500E-01	-0.	-0.
2	-.254600E-01	-0.	-0.
3	.184700E-01	-0.	-0.
4	-.199700E-01	-0.	-0.
5	-.199700E-01	-0.	-0.
6	-.331100E-01	-0.	-0.
7	.106300E-01	-0.	-0.
8	-.246600E-01	-0.	-0.
9	-.246600E-01	-0.	-0.
10	-.567200E-01	-0.	-0.
11	-.129100E-01	-0.	-0.
12	-.475400E-01	-0.	-0.
13	-.418800E-01	-0.	-0.
14	-.607800E-01	-0.	-0.
15	-.114600E+00	-0.	-0.
16	-.141000E+00	-0.	-0.
17	-.141000E+00	-0.	-0.
18	-.151100E+00	-0.	-0.
19	-.151700E+00	-0.	-0.
20	-.156800E+00	-0.	-0.
21	-.150600E+00	-0.	-0.
22	-.157400E+00	-0.	-0.
23	-.145900E+00	-0.	-0.
24	-.158400E+00	-0.	-0.
25	-.156400E+00	-0.	-0.
26	-.165200E+00	-0.	-0.
27	-.545300E+00	-0.	-0.
28	-.728700E+00	-0.	-0.
29	-.728700E+00	-0.	-0.
30	-.822000E+00	-0.	-0.
31	-.793500E+00	-0.	-0.
32	-.819700E+00	-0.	-0.
33	-.819700E+00	-0.	-0.
34	-.877600E+00	-0.	-0.
35	-.920000E+00	-0.	-0.
36	-.888800E+00	-0.	-0.
37	-.868600E+00	-0.	-0.
38	-.920000E+00	-0.	-0.
39	-.331100E-01	-0.	-0.
40	-.367200E-01	-0.	-0.
41	.183200E+00	-0.	-0.
42	-.381900E-01	-0.	-0.
43	-0.	0.	-.350000E+00
44	-0.	0.	-.400000E-01
45	-0.	0.	-.100000E+01
46	-0.	0.	0.
47	-0.	0.	.918000E+00

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NODE	PHIX(I,10)	PHIZ(I,10)	PHIY(I,10)
1	-.173600E+00	-0.	-0.
2	-.173600E+00	-0.	-0.
3	-.173600E+00	-0.	-0.
4	-.173600E+00	-0.	-0.
5	-.173600E+00	-0.	-0.
6	-.173600E+00	-0.	-0.
7	-.173600E+00	-0.	-0.
8	-.173600E+00	-0.	-0.
9	-.173600E+00	-0.	-0.
10	-.173600E+00	-0.	-0.
11	-.173600E+00	-0.	-0.
12	-.173600E+00	-0.	-0.
13	-.173600E+00	-0.	-0.
14	-.173600E+00	-0.	-0.
15	-.173600E+00	-0.	-0.
16	-.173600E+00	-0.	-0.
17	-.173600E+00	-0.	-0.
18	-.173600E+00	-0.	-0.
19	-.173600E+00	-0.	-0.
20	-.173600E+00	-0.	-0.
21	-.173600E+00	-0.	-0.
22	-.173600E+00	-0.	-0.
23	-.173600E+00	-0.	-0.
24	-.173600E+00	-0.	-0.
25	-.173600E+00	-0.	-0.
26	-.173600E+00	-0.	-0.
27	-.100000E+01	-0.	-0.
28	-.100000E+01	-0.	-0.
29	-.100000E+01	-0.	-0.
30	-.100000E+01	-0.	-0.
31	-.100000E+01	-0.	-0.
32	-.100000E+01	-0.	-0.
33	-.100000E+01	-0.	-0.
34	-.100000E+01	-0.	-0.
35	-.100000E+01	-0.	-0.
36	-.100000E+01	-0.	-0.
37	-.100000E+01	-0.	-0.
38	-.100000E+01	-0.	-0.
39	-.173600E+00	-0.	-0.
40	-.173600E+00	-0.	-0.
41	-.100000E+01	-0.	-0.
42	-.100000E+01	-0.	-0.
43	-0.	0.	.100000E+01
44	-0.	0.	.100000E+01
45	-0.	0.	.100000E+01
46	-0.	0.	.100000E+01
47	-0.	0.	.100000E+01

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NODE	PHIN(I,11)	PHIZ(I,11)	PHIV(I,11)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	0.	-0.	-0.
20	0.	-0.	-0.
21	0.	-0.	-0.
22	0.	-0.	-0.
23	0.	-0.	-0.
24	0.	-0.	-0.
25	0.	-0.	-0.
26	0.	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	-.823080E-01	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	-.521550E-01	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	-.209330E-01	-0.	-0.
39	0.	-0.	-0.
40	0.	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	0.	0.
44	-0.	0.	0.
45	-0.	0.	0.
46	-0.	0.	0.
47	-0.	0.	0.

DATE
TIME

NODE	PHIN(1,12)	PHIZ(1,12)	PHIY(1,12)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	-.711972E-01	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	-.653540E-01	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	0.	-0.	-0.
20	0.	-0.	-0.
21	0.	-0.	-0.
22	0.	-0.	-0.
23	0.	-0.	-0.
24	0.	-0.	-0.
25	0.	-0.	-0.
26	0.	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	0.	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	0.	-0.	-0.
39	0.	-0.	-0.
40	0.	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	0.	0.
44	-0.	0.	0.
45	-0.	0.	0.
46	-0.	0.	0.
47	-0.	0.	0.

DATE
TIME

NODE	PHIN(I,15)	PHIZ(I,15)	PHIY(I,15)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	.260900E+00	-0.	-0.
4	.260900E+00	-0.	-0.
5	.260900E+00	-0.	-0.
6	.260900E+00	-0.	-0.
7	.335100E+00	-0.	-0.
8	.335100E+00	-0.	-0.
9	.335100E+00	-0.	-0.
10	.335100E+00	-0.	-0.
11	[illegible]	-0.	-0.
12	[illegible]	-0.	-0.
13	[illegible]	-0.	-0.
14	[illegible]	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	0.	-0.	-0.
20	0.	-0.	-0.
21	0.	-0.	-0.
22	0.	-0.	-0.
23	0.	-0.	-0.
24	0.	-0.	-0.
25	0.	-0.	-0.
26	0.	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	0.	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	0.	-0.	-0.
39	.260900E+00	-0.	-0.
40	.335100E+00	-0.	-0.
41	.124000E-01	-0.	-0.
42	.124000E-01	-0.	-0.
43	-0.	.260900E+00	.550000E-01
44	-0.	.260900E+00	.550000E-01
45	-0.	0.	0.
46	-0.	0.	0.
47	-0.	0.	0.

DATE
TIME

NODE	PHIN(I,14)	PHIZ(I,14)	PHIY(I,14)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	.187900E+00	-0.	-0.
20	.187900E+00	-0.	-0.
21	.187900E+00	-0.	-0.
22	.187900E+00	-0.	-0.
23	.340200E+00	-0.	-0.
24	.340200E+00	-0.	-0.
25	.340200E+00	-0.	-0.
26	.340200E+00	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	0.	-0.	-0.
32	0.	-0.	-0.
33	0.	-0.	-0.
34	0.	-0.	-0.
35	0.	-0.	-0.
36	0.	-0.	-0.
37	0.	-0.	-0.
38	0.	-0.	-0.
39	0.	-0.	-0.
40	0.	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	0.	0.
44	-0.	0.	0.
45	-0.	0.	0.
46	-0.	0.	0.
47	-0.	0.	0.

DATE
TIME

NODE	PHIN(1,15)	PHIZ(1,15)	PHIY(1,15)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	0.	-0.	-0.
20	0.	-0.	-0.
21	0.	-0.	-0.
22	0.	-0.	-0.
23	0.	-0.	-0.
24	0.	-0.	-0.
25	0.	-0.	-0.
26	0.	-0.	-0.
27	0.	-0.	-0.
28	0.	-0.	-0.
29	0.	-0.	-0.
30	0.	-0.	-0.
31	-.1900000E+00	-0.	-0.
32	-.1900000E+00	-0.	-0.
33	-.1900000E+00	-0.	-0.
34	-.1900000E+00	-0.	-0.
35	-.3300000E+00	-0.	-0.
36	-.3300000E+00	-0.	-0.
37	-.3300000E+00	-0.	-0.
38	-.3300000E+00	-0.	-0.
39	0.	-0.	-0.
40	0.	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	0.	0.
44	-0.	0.	0.
45	-0.	0.	0.
46	-0.	0.	0.
47	-0.	0.	0.

DATE
TIME

NODE	PHIN(I,16)	PHIZ(I,16)	PHIY(I,16)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	.114000E+00	-0.	-0.
16	.141[illegible]E+00	-0.	-0.
17	.14[illegible]E+00	-0.	-0.
18	.151100E+00	-0.	-0.
19	.151500E+00	-0.	-0.
20	.150[illegible]E+00	-0.	-0.
21	.1[illegible]E+00	-0.	-0.
22	.151600E+00	-0.	-0.
23	.145900E+00	-0.	-0.
24	.156400E+00	-0.	-0.
25	.15[illegible]400E+00	-0.	-0.
26	.165200E+00	-0.	-0.
27	.[illegible]E+00	-0.	-0.
28	.720700E+00	-0.	-0.
29	.72[illegible]700E+00	-0.	-0.
30	.[illegible]3000E+00	-0.	-0.
31	.7[illegible]300E+00	-0.	-0.
32	.[illegible]19700E+00	-0.	-0.
33	.[illegible]15700E+00	-0.	-0.
34	.677000E+00	-0.	-0.
35	.[illegible]20000E+00	-0.	-0.
36	.686000E+00	-0.	-0.
37	.[illegible]00000E+00	-0.	-0.
38	.920000E+00	-0.	-0.
39	0.	-0.	-0.
40	0.	-0.	-0.
41	0.	-0.	-0.
42	0.	-0.	-0.
43	-0.	0.	0.
44	-0.	0.	0.
45	-0.	0.	-.100000E+01
46	-0.	0.	0.
47	-0.	0.	-.912000E+00

```
        ** ARRAY OF REDUCED FREQUENCIES **

  0.000000    .100000    .250000    .500000    .750000   1.000000

  1.250000   1.500000   1.750000   2.000000

REFERENCE CHORD     =      300.00000
REFERENCE SEMI-SPAN =      950.00000
REFERENCE AREA      =   406700.00000
MACH NUMBER         =         .85000
BETA                =         .52678
MOMENT AXIS         =     1000.00000

NUMBER OF PANELS    =    9
NUMBER OF BODIES    =    2

TOTAL N.D.U.F(KNOWN)=  154


          IPH1 =  0
          IPH2 =  0
          IPH3 =  0
          NO. GUST ORIENTATIONS = 13
```

```
     ***   SEGMENT  1   ***

  GENERATE GEOMETRY ARRAYS


     **  PANEL NO.   1 INPUT VALUES  **

  X1 =  740.000000  X2 = 1120.000000  Y1 =  120.000000  Z1 =    0.000000
  X3 =  695.610000  X4 = 1190.660000  Y2 =  375.000000  Z2 =   44.960000
  NC =  8  NS =  2
  GROUP NUMBER       =    1

        9  CHORDWISE DIVISIONS FOR PANEL  1
 0.             .125000E+00   .250000E+00   .375000E+00   .500000E+00   .622631E+00
 .745262E+00    .872631E+00   .100000E+01
        3  SPANWISE  DIVISIONS FOR PANEL  1
 0.             .411760E+00   .100000E+01
```

```
** PANEL NO. 2 INPUT VALUES **

X1 =  893.610000  X2 = 1114.990000  Y1 =  375.000000  Z1 =   44.960000
X3 =  938.800000  X4 = 1141.990000  Y2 =  450.000000  Z2 =   64.190000
NC =  6  NS =  1
GROUP NUMBER      =    1

       7  CHORDWISE DIVISIONS FOR PANEL  2
0.            .166667E+00    .333333E+00    .500000E+00    .666667E+00    .833333E+00
 .100000E+01
       2  SPANWISE  DIVISIONS FOR PANEL  2
0.            .100000E+01
```

```
    ** PANEL NO.   3 INPUT VALUES  **

 X1 = 1114.991000  X2 = 1190.460000  Y1 =  375.000000  Z1 =   44.960000
 X3 = 1141.990000  X4 = 1211.450000  Y2 =  450.000000  Z2 =   58.190000
 NC =  2  NS =  1
 GROUP NUMBER      =    1

        3  CHORDWISE DIVISIONS FOR PANEL  3
0.             .5000000E+00     .1000000E+01
        2  SPANWISE  DIVISIONS FOR PANEL  3
0.             .1000000E+01
```

```
** PANEL NO.   4 INPUT VALUES **

X1 =  938,400000  X2 = 1211,450000  Y1 =  450,000000  Z1 =   98,190000

X3 = 1240,000000  X4 = 1350,000000  Y2 =  950,000000  Z2 =  146,350000

NC =  8  NS =  4

GROUP NUMBER       =    1


        8  CHORDWISE DIVISIONS FOR PANEL  4

0.             ,125000E+00    ,250000E+00    ,375000E+00    ,500000E+00    ,622631E+00
 ,745262E+00   ,872631E+00    ,100000E+01

        5  SPANWISE  DIVISIONS FOR PANEL  4

0.             ,300000E+00    ,600000E+00    ,850000E+00    ,100000E+01
```

```
** PANEL NO.   5 INPUT VALUES **

X1 = 1860.000000  X2 = 1811.990000  Y1 =   40.000000  Z1 =  113.137000
X3 = 1840.000000  X4 = 1912.370000  Y2 =  375.000000  Z2 =  172.210000
NC =  4  NS =  5
GROUP NUMBER       =    2

      5  CHORDWISE DIVISIONS FOR PANEL  5
0.          .250000E+00    .500000E+00    .750000E+00    .100000E+01
      6  SPANWISE  DIVISIONS FOR PANEL  5
0.          .238810E+00    .403000E+00    .552240E+00    .776120E+00    .100000E+01
```

```
** PANEL NO. 6 INPUT VALUES **

X1 = 1811.930000  X2 = 1870.000000  Y1 =  80.000000  Z1 =  113.137000
X3 = 1912.370000  X4 = 1940.000000  Y2 =  375.000000  Z2 =  172.210000
NC =  2  NS =  5
GROUP NUMBER      =    2

        3  CHORDWISE DIVISIONS FOR PANEL  6
0.          .500000E+00     .100000E+01
        6  SPANWISE  DIVISIONS FOR PANEL  6
0.          .238810E+00     .403000E+00     .552240E+00     .776120E+00     .100000E+01
```

```
** PANEL NO.   7 INPUT VALUES **

X1 = 1545.000000  X2 = 1728.740000  Y1 =    0.000000  Z1 =  120.000000
X3 = 1820.000000  X4 = 1886.810000  Y2 =    0.000000  Z2 =  450.000000
NC =  4  NS =  4
GROUP NUMBER      =    3

        5  CHORDWISE DIVISIONS FOR PANEL  7
0.           .2500000E+00    .5000000E+00    .7500000E+00    .1000000E+01
        5  SPANWISE  DIVISIONS FOR PANEL  7
0.           .2727270E+00    .5757460E+00    .8787900E+00    .1000000E+01
```

```
** PANEL NO. 8 INPUT VALUES **

X1 = 1728.740000  X2 = 1920.000000  Y1 =    0.000000  Z1 =  120.000000
X3 = 1888.810000  X4 = 1920.000000  Y2 =    0.000000  Z2 =  450.000000
NC =  2  NS =  4
GROUP NUMBER         =    3

         3  CHORDWISE DIVISIONS FOR PANEL  8
0.              .500000E+00     .100000E+01
         5  SPANWISE  DIVISIONS FOR PANEL  8
0.              .272730E+00     .575760E+00     .878790E+00     .100000E+01
```

```
   **  PANEL NO.   9 INPUT VALUES  **

 X1 =  740.000000  X2 =  941.380000  Y1 =  375.000000  Z1 =    0.000000

 X3 =  893.810030  X4 = 1114.990000  Y2 =  375.000000  Z2 =   44.900000

 NC =  6  NS =  1

 GROUP NUMBER        =    1


         7  CHORDWISE DIVISIONS FOR PANEL  9

0.          .167727E+00    .335453E+00    .503179E+00    .670905E+00    .835453E+00
 .100000E+01

         2  SPANWISE  DIVISIONS FOR PANEL  9

0.          .100000E+01
```

** SUMMARY OF PANEL DATA **

PANEL	NC	NB	NR=ARRAY	DIHEDRAL ANGLE
1	8	2	16	9,99926
2	6	1	22	10,00406
3	2	1	24	10,00406
4	8	4	56	9,99961
5	4	5	76	10,00057
6	2	5	86	10,00057
7	4	4	102	90,00001
8	2	4	110	90,00001
9	6	1	116	90,00001

** GEOMETRY ARRAYS FOR ALL PANELS **

PANEL NO.	STRIP NO.	BOX NO.	3/4 CHORD X	1/4 CHORD X-COORDINATES INBOARD	CENTER	OUTBOARD	BOX CHORD DELTA-X	1/4 CHORD SWEEP ANGLE
1	1	1	805.84919	751.87500	782.96655	814.05809	45.36528	.52800
1	1	2	851.01447	797.37500	825.13153	857.26466	45.36528	.49760
1	1	3	896.37975	846.87500	873.49711	903.51922	45.36529	.46616
1	1	4	941.74503	894.37500	919.04239	943.74978	45.36528	.43369
1	1	5	986.46549	941.64974	964.21273	986.77552	44.50552	.40038
1	1	6	1030.97101	988.24975	1009.71325	1029.19678	44.50552	.36660
1	1	7	1076.76018	1035.29962	1053.65365	1072.00769	46.22504	.33158
1	1	8	1122.99122	1083.69984	1099.87470	1116.05756	46.22504	.29466
1	2	9	878.56591	814.05809	858.47545	902.89281	40.18091	.52800
1	2	10	918.74681	857.26466	899.65036	940.02406	40.18091	.49760
1	2	11	958.92772	900.51922	938.83727	977.15531	40.18091	.46616
1	2	12	999.12863	943.74978	979.01817	1014.28656	40.18091	.43369
1	2	13	1038.71840	986.77552	1019.00870	1051.24188	39.41940	.40038
1	2	14	1078.13780	1029.18678	1058.42810	1087.66942	39.41940	.36660
1	2	15	1118.69946	1072.00769	1098.22825	1124.44882	40.94242	.33158
1	2	16	1159.64188	1116.05756	1139.17067	1162.28378	40.94242	.29466
2	3	17	942.74063	902.83417	925.05021	947.26625	35.38084	.52814
2	3	18	978.12145	939.73083	960.43105	981.13125	35.38082	.49793
2	3	19	1013.50229	976.62749	995.81187	1014.99624	35.38084	.46669
2	3	20	1048.88318	1013.52419	1031.19273	1048.86127	35.38090	.43443
2	3	21	1084.26392	1050.42187	1066.57358	1082.72628	35.38069	.40116
2	3	22	1119.64477	1087.31744	1101.95432	1116.59120	35.38090	.36697
3	4	23	1155.70185	1124.44875	1137.56063	1150.67250	36.28250	.33162
3	4	24	1191.98438	1162.28375	1173.84313	1185.40250	36.28250	.29472
4	5	25	1007.25367	947.32031	991.73789	1036.15547	31.03156	.52800
4	5	26	1038.28523	981.40156	1022.76945	1064.13734	31.03156	.49760
4	5	27	1069.31680	1015.48281	1053.80102	1092.11922	31.03156	.46616
4	5	28	1100.34836	1049.56406	1084.83258	1120.10109	31.03156	.43370
4	5	29	1130.93084	1083.48384	1115.71711	1147.95039	30.44345	.40039
4	5	30	1161.38229	1116.91918	1146.16057	1175.40195	30.44345	.36660
4	5	31	1192.70791	1150.67747	1176.89807	1203.11867	31.61967	.33159
4	5	32	1224.32756	1185.40465	1208.51775	1231.61086	31.61967	.29466
4	6	33	1093.03914	1036.15547	1080.57305	1124.99063	24.93219	.52800
4	6	34	1117.97133	1064.13734	1105.50523	1146.87313	24.93219	.49760
4	6	35	1142.90352	1092.11922	1130.43742	1168.75563	24.93219	.46616
4	6	36	1167.83570	1120.10109	1155.36961	1190.63813	24.93219	.43370
4	6	37	1192.41350	1147.95039	1180.18367	1212.41695	24.45967	.40039
4	6	38	1216.87316	1175.40195	1204.64534	1233.88473	24.45967	.36660
4	6	39	1242.04162	1203.11867	1229.33927	1255.55987	25.40470	.33159
4	6	40	1267.44632	1231.63086	1254.74397	1277.85709	25.40470	.29466
4	7	41	1171.67582	1124.99063	1162.00527	1199.01992	19.34109	.52800
4	7	42	1191.01691	1146.87313	1181.34637	1215.81961	19.34109	.49760
4	7	43	1210.35801	1168.75563	1200.68746	1232.61930	19.34109	.46616
4	7	44	1229.69910	1190.63813	1220.02855	1249.41898	19.34109	.43370
4	7	45	1248.76528	1212.41695	1239.27801	1266.13907	18.97494	.40039

** GEOMETRY ARRAYS FOR ALL PANELS **

PANEL NO.	STRIP NO.	BOX NO.	1/4 CHORD X	1/4 CHORD X-COORDINATES INBOARD	CENTER	OUTBOARD	BOX CHORD DELTA-X	1/4 CHORD SWEEP ANGLE
4	7	46	1257.73982	1233.88473	1258.25295	1282.62037	18.97454	.36660
4	7	47	1257.26419	1255.55987	[illegible]	1299.26087	19.70765	.33159
4	7	48	[illegible]	[illegible]	[illegible]	1316.17894	19.70765	.29486
4	8	49	[illegible]	[illegible]	1221.22871	1243.43750	15.27484	.52000
4	8	50	[illegible]	[illegible]	1235.50355	1257.18750	15.27484	.49760
4	8	51	[illegible]	1232.61930	[illegible]	1270.93750	15.27484	.46616
4	8	52	[illegible]	1249.41898	[illegible]	1284.68750	15.27484	[illegible]
4	8	53	[illegible]	1266.13907	1282.25571	1298.37235	14.98515	[illegible]
4	8	54	[illegible]	1282.62037	1297.24107	1311.86176	14.98515	.36660
4	8	55	[illegible]	1297.26087	1312.37117	1325.48147	15.56433	.33159
4	8	56	1335.71767	1316.37894	1327.93550	1339.49206	15.56433	.29486
5	9	57	[illegible]	1669.49938	1690.39809	1711.29680	35.62074	.47520
5	9	58	[illegible]	1707.49685	1726.01883	1744.54078	35.62074	.42784
5	9	59	1779.44994	1765.49438	1761.63957	1777.78477	35.62074	.37834
5	9	60	1815.07069	1783.49188	1797.26032	1811.02876	35.62074	.32682
5	10	61	[illegible]	1711.29680	1725.66537	1740.03395	31.60989	.47520
5	10	62	[illegible]	1744.54078	1757.27526	1770.00973	31.60989	.42784
5	10	63	[illegible]	1777.78477	1789.88514	1799.98552	31.60989	.37834
5	10	64	[illegible]	1811.02876	1820.49503	1829.96130	31.60989	.32682
5	11	65	1767.33966	1740.03395	1753.09422	1766.15449	28.49047	.47520
5	11	66	1795.42993	1770.00973	1781.58469	1793.15965	28.49047	.42784
5	11	67	[illegible]	1799.98552	1810.07517	1820.16482	28.49047	.37834
5	11	68	[illegible]	1829.96130	1838.56564	1847.16998	28.49047	.32682
5	12	69	1798.13515	1766.15449	1785.74665	1805.33881	24.77700	.47520
5	12	70	[illegible]	1793.15965	1810.52365	1827.88764	24.77700	.42784
5	12	71	[illegible]	1820.16482	1835.30064	1850.43647	24.77700	.37834
5	12	72	[illegible]	1847.16998	1860.07764	1872.98530	24.77700	.32682
5	13	73	[illegible]	1805.33881	1824.93097	1844.52313	20.32067	.47520
5	13	74	[illegible]	1827.88764	1845.25163	1862.61563	20.32067	.42784
5	13	75	[illegible]	1850.43647	1865.57230	1880.70813	20.32067	.37834
5	13	76	[illegible]	1872.98530	1885.89296	1895.80063	20.32067	.32682
6	[illegible]	77	[illegible]	1819.24125	1830.77368	1842.30612	27.19124	.27665
6	14	78	[illegible]	1848.24625	1857.96492	1867.68359	27.19124	.23486
6	15	79	[illegible]	1842.30612	1850.23506	1859.16400	24.13045	.27665
6	15	80	[illegible]	1867.68359	1874.36551	1881.04743	24.13045	.23486
6	16	81	[illegible]	1859.16400	1865.87098	1872.57797	21.74995	.27665
6	16	82	1897.99591	1881.04743	1887.12094	1893.19444	21.74995	.23486
6	17	83	1892.84747	1872.57797	1883.38941	1894.20086	18.91611	.27665
6	17	84	1911.75357	1893.19444	1902.30552	1911.41660	18.91611	.23486
6	18	85	1912.76999	1894.20086	1905.01230	1915.82375	15.51537	.27665
6	18	86	1928.28536	1911.41660	1920.52767	1929.63875	15.51537	.23486
7	19	87	1613.96191	1556.48375	1592.98755	1627.49136	41.94871	.68153
7	19	88	1655.91062	1602.41875	1634.93626	1667.45378	41.94871	.62578
7	19	89	1697.85933	1648.35375	1676.88497	1705.41620	41.94871	.56506
7	19	90	1739.80804	1694.28875	1718.83368	1743.37862	41.94871	.49033

** GEOMETRY ARRAYS FOR ALL PANELS **

PANEL NO.	STRIP NO.	BOX NO.	1/4 CHORD X	1/4 CHORD X-COORDINATES INBOARD	CENTER	OUTBOARD	BOX CHORD DELTA-X	1/4 CHORD SWEEP ANGLE
7	20	91	1686,81734	1629,49136	1670,05069	1710,61002	33,53326	,68153
7	20	92	1723,35054	1667,45378	1703,58395	1739,71412	33,53326	,62574
7	20	93	1755,[illegible]	1705,41822	1737,11721	1769,81822	33,53326	,56506
7	20	94	1787,41[illegible]	1743,37862	1773,65046	1797,92231	33,53326	,49933
7	21	95	1765,5[illegible]	1710,61002	1751,16736	1791,72869	24,67493	,68153
7	21	96	1788,18176	1739,71412	1775,84024	1811,97446	24,67493	,62574
7	21	97	1812,[illegible]	1768,81822	1800,51923	1832,22024	24,67493	,56506
7	21	98	1837,33193	1797,92231	1825,19416	1852,16601	24,67493	,49933
7	22	99	1817,18923	1791,72869	1807,95216	1824,17563	18,47414	,68153
7	22	100	1835,66336	1811,97446	1826,42629	1840,87813	18,47414	,62574
7	22	101	1854,13750	1832,22024	1844,90043	1857,58063	18,47414	,56506
7	22	102	1872,53163	1852,46601	1863,37457	1874,28313	18,47414	,49933
8	23	103	1781,5[illegible]	1740,14750	1760,71288	1781,27825	41,67064	,42866
8	23	104	1823,21884	1785,77750	1802,38352	1818,98954	41,67064	,35352
8	24	105	1822,78[illegible]	1781,27825	1804,12842	1826,97859	33,31205	,42866
8	24	106	1854,09549	1818,98954	1837,44047	1855,89139	33,31205	,35352
8	25	107	1862,38554	1826,97859	1849,82675	1872,67892	24,51357	,42866
8	25	108	1886,59911	1855,89139	1874,34232	1892,79325	24,51357	,35352
8	26	109	1890,99617	1872,67892	1881,81683	1890,95875	18,35467	,42866
8	26	110	1909,35363	1892,79325	1900,17350	1907,55375	18,35467	,35352
9	27	111	844,65355	749,28285	826,08785	902,89285	37,13140	1,28606
9	27	112	881,78479	786,41420	863,21920	940,02420	37,13118	1,28606
9	27	113	918,91597	823,54538	900,35038	977,15538	37,13118	1,28606
9	27	114	956,04715	860,67656	937,48156	1014,28656	37,13118	1,28606
9	27	115	992,65068	897,63186	974,43686	1051,24186	36,42764	1,28606
9	27	116	1029,07815	934,05944	1010,86444	1087,66944	36,42761	1,28606

STRIP	Y	Z	DELTA-Y	DELTA-Z	E	CHORD	X-L.E.
1	172,49940	9,25616	104,99587	18,51273	53,30917	362,92225	771,62523
2	299,99940	31,73636	150,00120	26,44727	76,15743	321,44725	848,43023
3	412,50000	51,57500	75,00000	13,23000	38,07897	212,28500	916,23500
4	412,50000	51,57500	75,00000	13,23000	38,07897	72,56500	1128,49000
5	525,00000	71,41400	150,00000	26,44800	76,15690	248,25250	983,98000
6	675,00000	97,86200	150,00000	26,44800	76,15690	109,45750	1074,34000
7	812,50000	122,10600	125,00000	22,04000	63,46409	154,72875	1157,17000
8	912,50000	139,73800	75,00000	13,22400	38,07945	122,19875	1217,41000
9	80,00067	120,19061	80,00135	14,10722	40,61782	142,48297	1681,44290
10	147,50314	132,09382	55,00365	9,69920	27,92613	126,43954	1717,76290
11	200,00270	141,35145	49,99540	8,81605	25,38337	113,98190	1745,97160
12	262,50030	152,37211	74,99980	13,22526	38,07846	99,10799	1779,55240
13	337,50010	165,59737	74,99980	13,22526	38,07846	81,28266	1819,85080
14	80,00067	120,19061	80,00135	14,10722	40,61782	54,38248	1823,07587
15	147,50318	132,09382	55,00365	9,69920	27,92613	48,26091	1844,20244
16	200,00270	141,35145	49,99540	8,81605	25,38337	43,49990	1859,93359
17	262,50030	152,37211	74,99980	13,22526	38,07846	37,83221	1878,66039
18	337,50010	165,59737	74,99980	13,22526	38,07846	31,03074	1901,13345
19	0,00000	165,00045	0,00000	90,00090	45,00045	167,79488	1582,50038
20	0,00000	260,00085	0,00000	99,99990	49,99995	134,13303	1661,66738
21	0,00000	360,00075	0,00000	99,99990	49,99995	98,69973	1745,00063
22	0,00000	430,00035	0,00000	39,99930	19,99965	73,89654	1803,33303
23	0,00000	165,00045	0,00000	90,00090	45,00045	83,34128	1750,29522
24	0,00000	260,00085	0,00000	99,99990	49,99995	66,62409	1795,80041
25	0,00000	360,00075	0,00000	99,99990	49,99995	49,02714	1843,70036
26	0,00000	430,00035	0,00000	39,99930	19,99965	36,70933	1877,23017
27	375,00000	22,48000	0,00000	44,96000	22,48000	221,38000	816,80500

```
** BODY NO.   1  INPUT VALUES **

CENTER OF BODY COORDINATES   Y =     0.000000     Z =     0.000000
AVERAGE HALF-WIDTH OF BODY   =    120.000000
CROSS-SECTIONAL ASPECT RATIO =      1.000000
NUMBER OF INTERFERENCE ELEMENTS ON BODY =   4
NUMBER OF SLENDER BODY ELEMENTS =          14
Z-Y ORIENTATION FLAG   =  2
XI-FLAG =  0  R-S FLAG =  1

  5  XI-I ELEMENTS FOR BODY  1

.650000E+03   .800000E+03   .950000E+03   .114000E+04   .125000E+04

  5  R-I  ELEMENTS FOR BODY  1

.120000E+03   .120000E+03   .120000E+03   .120000E+03   .120000E+03

  4  THETA   ELEMENTS FOR BODY  1

.450000E+02   .135000E+03   .225000E+03   .315000E+03

 15  XI-S ELEMENTS FOR BODY  1

0.            .250000E+02   .100000E+03   .200000E+03   .300000E+03   .475000E+03
.650000E+03   .800000E+03   .950000E+03   .112000E+04   .125000E+04   .138000E+04
.160000E+04   .175000E+04   .191200E+04

 15  R-S  ELEMENTS FOR BODY  1

0.            .350000E+02   .700000E+02   .900000E+02   .100000E+03   .110000E+03
.120000E+03   .120000E+03   .120000E+03   .120000E+03   .120000E+03   .120000E+03
.850000E+02   .600000E+02   0.
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        ** BODY NO.  2  INPUT VALUES **

    CENTER OF BODY COORDINATES   Y =  375.000000      Z =  -55.000000
    AVERAGE HALF-WIDTH OF BODY   =      55.000000
    CROSS-SECTIONAL ASPECT RATIO =       1.000000
    NUMBER OF INTERFERENCE ELEMENTS ON BODY =   4
    NUMBER OF SLENDER BODY ELEMENTS =           5
    Z-Y ORIENTATION FLAG   =  2
    RI-FLAG =  0   R-B FLAG =  1

   5  X(I) ELEMENTS FOR BODY  2

.740000E+03   .814283E+03   .888545E+03   .961380E+03   .111900E+04

   5  R(I)  ELEMENTS FOR BODY  2

.550000E+02   .550000E+02   .550000E+02   .550000E+02   .550000E+02

   4  THETA   ELEMENTS FOR BODY  2

.450000E+02   .135000E+03   .225000E+03   .315000E+03

   6  X(B) ELEMENTS FOR BODY  2

.650000E+03   .660000E+03   .680000E+03   .765000E+03   .95[illegible]E+03   .9[illegible]E+03

   6  R(B)  ELEMENTS FOR BODY  2

0.            .450000E+02   .550000E+02   .550000E+02   .550000E+02   .45[illegible]E+0[illegible]
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** GEOMETRY ARRAYS FOR ALL BODIES **

BODY NUMBER	INTERFERENCE SEGMENT NUMBER	X-I	Y-I	Z-I	R-I	GAMMA
1	1	725.00000	0.00000	0.00000	120.00000	0.00000
1	2	875.00000	0.00000	0.00000	120.00000	0.00000
1	3	1025.00000	0.00000	0.00000	120.00000	0.00000
1	4	1175.00000	0.00000	0.00000	120.00000	0.00000
2	5	777.11150	375.00000	-55.00000	55.00000	0.00000
2	6	851.39400	375.00000	-55.00000	55.00000	0.00000
2	7	924.95250	375.00000	-55.00000	55.00000	0.00000
2	8	1038.10000	375.00000	-55.00000	55.00000	0.00000

SLENDER BODY NUMBER	SEGMENT NUMBER	XIB1	XIB2	A0	A0-PRIME
1	1	0.00000	25.00000	17.50000	1.40000
1	2	25.00000	100.00000	52.50000	.46667
1	3	100.00000	200.00000	80.00000	.20000
1	4	200.00000	300.00000	95.00000	.10000
1	5	300.00000	475.00000	105.00000	.05714
1	6	475.00000	650.00000	115.00000	.05714
1	7	650.00000	800.00000	120.00000	0.00000
1	8	800.00000	950.00000	120.00000	0.00000
1	9	950.00000	1120.00000	120.00000	0.00000
1	10	1120.00000	1250.00000	120.00000	0.00000
1	11	1250.00000	1380.00000	120.00000	0.00000
1	12	1380.00000	1600.00000	102.50000	-.15909
1	13	1600.00000	1750.00000	72.50000	-.16667
1	14	1750.00000	1912.00000	30.00000	-.37037
2	15	650.00000	660.00000	22.50000	4.50000
2	16	660.00000	680.00000	50.00000	.50000
2	17	680.00000	765.00000	55.00000	0.00000
2	18	765.00000	850.00000	55.00000	0.00000
2	19	850.00000	920.00000	40.00000	-.42857

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***   SEGMENT  7   ***

CALCULATE FORCES FOR MODES AND GUST,  AND GENERALIZED FORCES


GENERALIZED FORCE COLUMN        1 OF MATRIX   DPUB

  .942541E-10    0.            .303452E-09    0.            0.               0.
 -.595450E-12    0.           -.155320E-09    0.           -.132974E-10      0.
  .601490E-10    0.

GENERALIZED FORCE COLUMN        2 OF MATRIX   DPUB

 -.140870E+04    0.           -.109568E+03    0.            0.               0.
 -.873309E-01    0.            .505125E+03    0.            .159809E+02      0.
 -.794724E+02    0.

GENERALIZED FORCE COLUMN        3 OF MATRIX   DPUB

 0.              0.            0.             0.            0.               0.
 0.              0.            0.             0.            0.               0.
 0.              0.

GENERALIZED FORCE COLUMN        4 OF MATRIX   DPUB

 -.140810E+03    0.           -.115196E+03    0.            0.               0.
 -.755439E+00    0.            .149811E+01    0.            .232669E+02      0.
 -.115009E+03    0.

GENERALIZED FORCE COLUMN        5 OF MATRIX   DPUB

 -.132574E-01    0.           -.285874E-02    0.            0.               0.
 -.130614E-05    0.            .702302E-02    0.            .232782E-03      0.
 -.110525E-02    0.

GENERALIZED FORCE COLUMN        6 OF MATRIX   DPUB

 -.123011E-02    0.           -.110904E-02    0.            0.               0.
 -.687920E-05    0.            .935541E-05    0.            .414219E-03      0.
 -.110792E-02    0.

GENERALIZED FORCE COLUMN        7 OF MATRIX   DPUB

 -.253059E+03    0.           -.159614E+03    0.            0.               0.
 -.177315E+00    0.            .167335E+02    0.            .338804E+02      0.
 -.154475E+03    0.

GENERALIZED GUST FORCE COLUMN   1 OF MATRIX   FOPB

 -.734246E+04    0.           -.547529E+05    0.            0.               0.
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-.432662E+04	0.	.252552E+06	0.	.798508E+04	0.
-.397096E+05	0.				

GENERALIZED GUST FORCE COLUMN 2 OF MATRIX FGPB

-[illegible]	0.	-[illegible]	0.	0.	0.
-[illegible]	0.	[illegible]	0.	[illegible]	0.
-[illegible]	0.				

GENERALIZED GUST FORCE COLUMN 3 OF MATRIX FGPB

-.146849E+07	0.	-.109505E+06	0.	0.	0.
-.865325E+02	0.	.505103E+06	0.	.159702E+05	0.
-.794195E+05	0.				

S/B same as Column 2 of DPOS x 10^3 (.001 Radian Rotation used for R.B. Pitch)

GENERALIZED GUST FORCE COLUMN 4 OF MATRIX FGPB

-.105838E+07	0.	-.774317E+05	0.	0.	0.
-.611877E+02	0.	.357162E+06	0.	.112926E+05	0.
-.561579E+05	0.				

GENERALIZED GUST FORCE COLUMN 5 OF MATRIX FGPB

.105838E+07	0.	.774317E+05	0.	0.	0.
.611877E+02	0.	-.357162E+06	0.	-.112926E+05	0.
.561579E+05	0.				

GENERALIZED GUST FORCE COLUMN 6 OF MATRIX FGPB

.146849E+07	0.	.109505E+06	0.	0.	0.
.865325E+02	0.	-.505103E+06	0.	-.159702E+05	0.
.794195E+05	0.				

GENERALIZED GUST FORCE COLUMN 7 OF MATRIX FGPB

.127175E+07	0.	.948340E+05	0.	0.	0.
.749393E+02	0.	-.437432E+06	0.	-.138306E+05	0.
.687791E+05	0.				

GENERALIZED GUST FORCE COLUMN 8 OF MATRIX FGPB

.734246E+06	0.	.547525E+05	0.	0.	0.
.432662E+02	0.	-.252552E+06	0.	-.798508E+04	0.
.397096E+05	0.				

GENERALIZED GUST FORCE COLUMN 9 OF MATRIX FGPB

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.				

GENERALIZED GUST FORCE COLUMN 10 OF MATRIX FGPB

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.				

GENERALIZED GUST FORCE COLUMN 11 OF MATRIX FGPB

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.				

GENERALIZED GUST FORCE COLUMN 12 OF MATRIX FGPB

-.1038818E+07	0.	-.7745178E+05	0.	0.	0.
-.6118772E+02	0.	.3571628E+06	0.	.1129262E+05	0.
-.5615798E+05	0.				

GENERALIZED GUST FORCE COLUMN 13 OF MATRIX FGPB

.1038818E+07	0.	.7745178E+05	0.	0.	0.
.6118772E+02	0.	-.3571628E+06	0.	-.1129262E+05	0.
.5615798E+05	0.				

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GENERALIZED FORCE COLUMN       1 OF MATRIX   DZOS

 -.660759E-10     0.            .465402E-10    0.          0.          0.
 0.               0.           -.465832E-11    0.          0.          0.
 -.112171E-10     0.

GENERALIZED FORCE COLUMN       2 OF MATRIX   DZOS

 -.201920E+03     0.            .815763E+02    0.          0.          0.
 0.               0.            .598755E+00    0.          0.          0.
 -.260928E+02     0.

GENERALIZED FORCE COLUMN       3 OF MATRIX   DZOS

 0.               0.           0.              0.          0.          0.
 0.               0.           0.              0.          0.          0.
 0.               0.

GENERALIZED FORCE COLUMN       4 OF MATRIX   DZOS

 -.450068E+01     0.           -.247420E+01    0.          0.          0.
 0.               0.            .131483E-01    0.          0.          0.
 -.248192E+01     0.

GENERALIZED FORCE COLUMN       5 OF MATRIX   DZOS

 -.237204E-03     0.            .115666E-03    0.          0.          0.
 0.               0.            .249372E-04    0.          0.          0.
 -.140326E-03     0.

GENERALIZED FORCE COLUMN       6 OF MATRIX   DZOS

  .966083E-04     0.            .643464E-04    0.          0.          0.
 0.               0.            .665052E-07    0.          0.          0.
  .596601E-04     0.

GENERALIZED FORCE COLUMN       7 OF MATRIX   DZOS

 -.215435E+02     0.           -.144601E+02    0.          0.          0.
 0.               0.            .216557E+00    0.          0.          0.
  .497665E+02     0.

GENERALIZED GUST FORCE COLUMN  1 OF MATRIX   FGZS

 -.100941E+06     0.            .407663E+05    0.          0.          0.
 0.               0.            .299123E+05    0.          0.          0.
 -.149457E+05     0.

GENERALIZED GUST FORCE COLUMN  2 OF MATRIX   FGZS
```

-.174834E+06	0.	.706474E+05	0.	0.	0.
0.	0.	.516095E+03	0.	0.	0.
-.248847E+05	0.				

GENERALIZED GUST FORCE COLUMN 3 OF MATRIX FGZS

-.201681E+06	0.	.815766E+05	0.	0.	0.
0.	0.	.596245E+03	0.	0.	0.
-.226392E+05	0.				

GENERALIZED GUST FORCE COLUMN 4 OF MATRIX FGZS

-.142752E+06	0.	.576634E+05	0.	0.	0.
0.	0.	.425023E+03	0.	0.	0.
-.202875E+05	0.				

GENERALIZED GUST FORCE COLUMN 5 OF MATRIX FGZS

.142752E+06	0.	-.576634E+05	0.	0.	0.
0.	0.	-.425023E+03	0.	0.	0.
.202875E+05	0.				

GENERALIZED GUST FORCE COLUMN 6 OF MATRIX FGZS

.201681E+06	0.	-.815766E+05	0.	0.	0.
0.	0.	-.596245E+03	0.	0.	0.
.226392E+05	0.				

GENERALIZED GUST FORCE COLUMN 7 OF MATRIX FGZS

.174834E+06	0.	-.706474E+05	0.	0.	0.
0.	0.	-.516095E+03	0.	0.	0.
.248847E+05	0.				

GENERALIZED GUST FORCE COLUMN 8 OF MATRIX FGZS

.100941E+06	0.	-.407683E+05	0.	0.	0.
0.	0.	-.299123E+03	0.	0.	0.
.143434E+05	0.				

GENERALIZED GUST FORCE COLUMN 9 OF MATRIX FGZS

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.				

GENERALIZED GUST FORCE COLUMN 10 OF MATRIX FGZS

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.				

GENERALIZED GUST FORCE COLUMN 11 OF MATRIX FGZS

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.				

GENERALIZED GUST FORCE COLUMN 12 OF MATRIX   FGZS

-.142752E+06	0.	.576634E+05	0.	0.	0.
0.	0.	.425025E+03	0.	0.	0.
-.202675E+05	0.				

GENERALIZED GUST FORCE COLUMN 14 OF MATRIX   FGZS

.142752E+06	0.	-.576634E+05	0.	0.	0.
0.	0.	-.425025E+03	0.	0.	0.
.202675E+05	0.				

```
GENERALIZED FORCE COLUMN      1 OF MATRIX   DYUB
 0.          0.          0.           0.          0.          0.
 0.          0.           .418730E-11 0.          0.          0.
 0.          0.

GENERALIZED FORCE COLUMN      2 OF MATRIX   DYUB
 0.          0.          0.           0.          0.          0.
 0.          0.           .203635E+01 0.          0.          0.
 0.          0.

GENERALIZED FORCE COLUMN      3 OF MATRIX   DYUB
 0.          0.          0.           0.          0.          0.
 0.          0.          0.           0.          0.          0.
 0.          0.

GENERALIZED FORCE COLUMN      4 OF MATRIX   DYUB
 0.          0.          0.           0.          0.          0.
 0.          0.           .422041E-02 0.          0.          0.
 0.          0.

GENERALIZED FORCE COLUMN      5 OF MATRIX   DYUB
 0.          0.          0.           0.          0.          0.
 0.          0.           .113189E-04 0.          0.          0.
 0.          0.

GENERALIZED FORCE COLUMN      6 OF MATRIX   DYUB
 0.          0.          0.           0.          0.          0.
 0.          0.           .265798E-07 0.          0.          0.
 0.          0.

GENERALIZED FORCE COLUMN      7 OF MATRIX   DYUB
 0.          0.          0.           0.          0.          0.
 0.          0.          -.140037E-01 0.          0.          0.
 0.          0.

GENERALIZED GUST FORCE COLUMN 1 OF MATRIX   FGYB
 0.          0.          0.           0.          0.          0.
 0.          0.           .101914E+04 0.          0.          0.
 0.          0.

GENERALIZED GUST FORCE COLUMN 2 OF MATRIX   FGYB
```

```
0.          0.          0.              0.          0.          0.
0.          0.          .176521E+04     0.          0.          0.
0.          0.

GENERALIZED GUST FORCE COLUMN  3 OF MATRIX   FGYB

0.          0.          0.              0.          0.          0.
0.          0.          [illegible]     0.          0.          0.
0.          0.

GENERALIZED GUST FORCE COLUMN  4 OF MATRIX   FGYB

0.          0.          0.              0.          0.          0.
0.          0.          .144129E+04     0.          0.          0.
0.          0.

GENERALIZED GUST FORCE COLUMN  5 OF MATRIX   FGYB

0.          0.          0.              0.          0.          0.
0.          0.          -.144129E+04    0.          0.          0.
0.          0.

GENERALIZED GUST FORCE COLUMN  6 OF MATRIX   FGYB

0.          0.          0.              0.          0.          0.
0.          0.          -.203829E+04    0.          0.          0.
0.          0.

GENERALIZED GUST FORCE COLUMN  7 OF MATRIX   FGYB

0.          0.          0.              0.          0.          0.
0.          0.          -.176521E+04    0.          0.          0.
0.          0.

GENERALIZED GUST FORCE COLUMN  8 OF MATRIX   FGYB

0.          0.          0.              0.          0.          0.
0.          0.          -.101914E+04    0.          0.          0.
0.          0.

GENERALIZED GUST FORCE COLUMN  9 OF MATRIX   FGYB

0.          0.          0.              0.          0.          0.
0.          0.          0.              0.          0.          0.
0.          0.

GENERALIZED GUST FORCE COLUMN 10 OF MATRIX   FGYB

0.          0.          0.              0.          0.          0.
0.          0.          0.              0.          0.          0.
0.          0.

GENERALIZED GUST FORCE COLUMN 11 OF MATRIX   FGYB

0.          0.          0.              0.          0.          0.
0.          0.          0.              0.          0.          0.
```

AD-A106 480 DOUGLAS AIRCRAFT CO LONG BEACH CA F/G 18/3
NUCLEAR BLAST RESPONSE COMPUTER PROGRAM. VOLUME I. PROGRAM DESC--ETC(U)
AUG 81 J A MCGREW, J P GIESING, T P KALMAN DNA001-75-C-0216

UNCLASSIFIED AFWL-TR-81-32-VOL-1 NL

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AD A106480

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 0.            0.

GENERALIZED GUST FORCE COLUMN 12 OF MATRIX   PGYB

 0.            0.            0.            0.            0.            0.
 0.            0.             .144129E+04  0.            0.            0.
 0.            0.

GENERALIZED GUST FORCE COLUMN 13 OF MATRIX   PGYB

 0.            0.            0.            0.            0.            0.
 0.            0.            -.144129E+04  0.            0.            0.
 0.            0.
```

GENERALIZED FORCE COLUMN 1 OF MATRIX UPUA

-.112524E+00	0.	-.202356E+00	0.	-.211132E+00	0.
.231694E-02	0.	.188277E-04	0.	-.163708E-01	0.
.460411E-01	0.	-.387465E-01	0.	.194713E+00	0.

GENERALIZED FORCE COLUMN 2 OF MATRIX UPUA

-.112492E+03	0.	-.646331E+02	0.	-.127676E+03	0.
-.177505E+00	0.	-.240893E-01	0.	.706150E+02	0.
-.[illegible]E+01	0.	-.150040E+02	0.	.645749E+02	0.

GENERALIZED FORCE COLUMN 3 OF MATRIX UPUA

.695858E-10	0.	.132291E-09	0.	.177311E-09	0.
.341314E-12	0.	.105585E-12	0.	-.378208E-10	0.
.974600E-11	0.	.209602E-10	0.	-.126015E-09	0.

GENERALIZED FORCE COLUMN 4 OF MATRIX UPUA

-.140954E+02	0.	-.531254E+02	0.	-.674212E+02	0.
-.[illegible]E+00	0.	.417501E-04	0.	-.151864E-01	0.
-.362056E+01	0.	-.115341E+02	0.	.531287E+02	0.

GENERALIZED FORCE COLUMN 5 OF MATRIX UPUA

-.[illegible]E+02	0.	.145519E+01	0.	-.515776E+01	0.
.[illegible]E-02	0.	-.197879E+00	0.	.165261E+02	0.
-.640556E+00	0.	.392969E+00	0.	-.251109E+01	0.

GENERALIZED FORCE COLUMN 6 OF MATRIX UPUA

-.816275E-02	0.	-.257918E-03	0.	-.187465E-02	0.
.[illegible]E-05	0.	.195591E-05	0.	.668446E-02	0.
.195575E-03	0.	.492473E-04	0.	-.637765E-04	0.

GENERALIZED FORCE COLUMN 7 OF MATRIX UPUA

-.550535E-03	0.	-.330045E-03	0.	-.407815E-03	0.
-.257355E-06	0.	-.166667E-06	0.	.167692E-05	0.
.415075E-03	0.	-.169417E-04	0.	.330492E-03	0.

GENERALIZED FORCE COLUMN 8 OF MATRIX UPUA

.72[illegible]E-11	0.	.269699E-10	0.	.381387E-10	0.
.[illegible]E-13	0.	-.466666E-16	0.	.239473E-13	0.
.[illegible]E-11	0.	.582503E-11	0.	-.269126E-10	0.

GENERALIZED FORCE COLUMN 9 OF MATRIX UPUA

.202291E+02	0.	.721400E+02	0.	.996464E+02	0.
.117530[illegible]+00	0.	.121148E-03	0.	-.101310E+00	0.
-.25313[illegible]+00	0.	.102507E+02	0.	-.721993E+02	0.

GENERALIZED GUST FORCE COLUMN 1 OF MATRIX FGPA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 2 OF MATRIX FGPA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 3 OF MATRIX FGPA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 4 OF MATRIX FGPA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 5 OF MATRIX FGPA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 6 OF MATRIX FGPA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 7 OF MATRIX FGPA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 8 OF MATRIX FGPA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 9 OF MATRIX FGPA

-.795524[illegible]+05	0.	-.456064E+05	0.	-.902361E+05	0.
-.12511[illegible]+05	0.	-.170457E+02	0.	.499361E+05	0.
-.202371E+04	0.	-.106591E+05	0.	.456236E+05	0.

GENERALIZED GUST FORCE COLUMN 10 OF MATRIX FGPA

-.11247[illegible]	0.	-.647860E+05	0.	-.127613E+06	0.
-.17[illegible]	0.	-.241062E+02	0.	.706203E+05	0.
-.26[illegible]E+04	0.	-.156745E+05	0.	.645215E+05	0.

GENERALIZED GUST FORCE COLUMN 11 OF MATRIX FGPA

-.795532E+05	0.	-.458064E+05	0.	-.902361E+05	0.
-.125113E+05	0.	-.170457E+02	0.	.499361E+05	0.
-.262371E+04	0.	-.106591E+05	0.	.456236E+05	0.

GENERALIZED GUST FORCE COLUMN 12 OF MATRIX FGPA

-.795532E+05	0.	-.458064E+05	0.	-.902361E+05	0.
-.125113E+05	0.	-.170457E+02	0.	.499361E+05	0.
-.262371E+04	0.	-.106591E+05	0.	.456236E+05	0.

GENERALIZED GUST FORCE COLUMN 13 OF MATRIX FGPA

-.795532E+05	0.	-.458064E+05	0.	-.902361E+05	0.
-.125113E+05	0.	-.170457E+02	0.	.499361E+05	0.
-.262371E+04	0.	-.106591E+05	0.	.456236E+05	0.

```
GENERALIZED FORCE COLUMN        1 OF MATRIX   DZUA

  .162779E-01    0.          0.          0.                0.              0.
 0.              0.          0.          0.              -.113251E-01      0.
 0.              0.          0.          0.               0.               0.

GENERALIZED FORCE COLUMN        2 OF MATRIX   DZUA

  .382174E+00    0.          0.          0.                0.              0.
 0.              0.          0.          0.              -.265891E+00      0.
 0.              0.          0.          0.               0.               0.

GENERALIZED FORCE COLUMN        3 OF MATRIX   DZUA

  .145672E-11    0.          0.          0.                0.              0.
 0.              0.          0.          0.              -.101466E-11      0.
 0.              0.          0.          0.               0.               0.

GENERALIZED FORCE COLUMN        4 OF MATRIX   DZUA

  .659504E-04    0.          0.          0.                0.              0.
 0.              0.          0.          0.              -.598041E-03      0.
 0.              0.          0.          0.               0.               0.

GENERALIZED FORCE COLUMN        5 OF MATRIX   DZUA

 -.250251E-01    0.          0.          0.                0.              0.
 0.              0.          0.          0.               .160193E-01      0.
 0.              0.          0.          0.               0.               0.

GENERALIZED FORCE COLUMN        6 OF MATRIX   DZUA

 -.287311E-04    0.          0.          0.                0.              0.
 0.              0.          0.          0.               .199892E-04      0.
 0.              0.          0.          0.               0.               0.

GENERALIZED FORCE COLUMN        7 OF MATRIX   DZUA

 -.455660E-08    0.          0.          0.                0.              0.
 0.              0.          0.          0.               .317157E-08      0.
 0.              0.          0.          0.               0.               0.

GENERALIZED FORCE COLUMN        8 OF MATRIX   DZUA

 -.697252E-15    0.          0.          0.                0.              0.
 0.              0.          0.          0.               .485122E-15      0.
 0.              0.          0.          0.               0.               0.

GENERALIZED FORCE COLUMN        9 OF MATRIX   DZUA
```

[illegible]	0.	0.	0.	0.	0.
0.	0.	0.	0.	.216415E-01	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 1 OF MATRIX FGZA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 2 OF MATRIX FGZA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 3 OF MATRIX FGZA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 4 OF MATRIX FGZA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 5 OF MATRIX FGZA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 6 OF MATRIX FGZA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 7 OF MATRIX FGZA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 8 OF MATRIX FGZA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 9 OF MATRIX FGZA

[illegible]	0.	0.	0.	0.	0.
0.	0.	0.	0.	-.188023E+03	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 10 OF MATRIX FGZA

[illegible]	0.	0.	0.	0.	0.
0.	0.	0.	0.	-.265905E+03	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 11 OF MATRIX FGZA

.270251E+03	0.	0.	0.	0.	0.
0.	0.	0.	0.	-.188023E+03	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 12 OF MATRIX FGZA

.270251E+03	0.	0.	0.	0.	0.
0.	0.	0.	0.	-.188023E+03	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 13 OF MATRIX FGZA

.270251E+03	0.	0.	0.	0.	0.
0.	0.	0.	0.	-.188023E+03	0.
0.	0.	0.	0.	0.	0.

GENERALIZED FORCE COLUMN 1 OF MATRIX DYUA

[illegible]	0.	.275015E+01	0.	.507652E-01	0.
0.	0.	0.	0.	.933354E-02	0.
0.	0.	0.	0.	-.253529E+01	0.

GENERALIZED FORCE COLUMN 2 OF MATRIX DYUA

.246643E+01	0.	.593962E+02	0.	-.667182E+01	0.
0.	0.	0.	0.	-.550389E-01	0.
0.	0.	0.	0.	.100083E+02	0.

GENERALIZED FORCE COLUMN 3 OF MATRIX DYUA

.143490E-12	0.	.495157E-11	0.	.235397E-10	0.
0.	0.	0.	0.	.617708E-12	0.
0.	0.	0.	0.	-.800154E-11	0.

GENERALIZED FORCE COLUMN 4 OF MATRIX DYUA

-.179700E+00	0.	-.119043E+01	0.	-.301259E+01	0.
0.	0.	0.	0.	-.138823E-02	0.
0.	0.	0.	0.	.168266E+01	0.

GENERALIZED FORCE COLUMN 5 OF MATRIX DYUA

.101700E-01	0.	.185015E+00	0.	.447697E+00	0.
0.	0.	0.	0.	.154034E-02	0.
0.	0.	0.	0.	-.151690E+00	0.

GENERALIZED FORCE COLUMN 6 OF MATRIX DYUA

-.117020E-04	0.	-.652556E-04	0.	.671478E-04	0.
0.	0.	0.	0.	.897668E-05	0.
0.	0.	0.	0.	.213707E-04	0.

GENERALIZED FORCE COLUMN 7 OF MATRIX DYUA

.182294E-05	0.	.180466E-04	0.	.277377E-04	0.
0.	0.	0.	0.	-.648490E-08	0.
0.	0.	0.	0.	-.164692E-04	0.

GENERALIZED FORCE COLUMN 8 OF MATRIX DYUA

.200894E-12	0.	.214609E-11	0.	.415925E-11	0.
0.	0.	0.	0.	.571742E-15	0.
0.	0.	0.	0.	-.187977E-11	0.

GENERALIZED FORCE COLUMN 9 OF MATRIX DYUA

[illegible]	0.	.122717E+02	0.	.685133E+01	0.
0.	0.	0.	0.	-.127707E-01	0.
0.	0.	0.	0.	.519277E+02	0.

0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 10 OF MATRIX FGZA

.382193E+03	0.	0.	0.	0.	0.
0.	0.	0.	0.	-.382193E+03	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 11 OF MATRIX FGZA

.270251E+03	0.	0.	0.	0.	0.
0.	0.	0.	0.	-.270251E+03	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 12 OF MATRIX FGZA

.270251E+03	0.	0.	0.	0.	0.
0.	0.	0.	0.	-.270251E+03	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 13 OF MATRIX FGZA

.270251E+03	0.	0.	0.	0.	0.
0.	0.	0.	0.	-.270251E+03	0.
0.	0.	0.	0.	0.	0.

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 2 OF MATRIX FGYA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 3 OF MATRIX FGYA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 4 OF MATRIX FGYA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 5 OF MATRIX FGYA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 6 OF MATRIX FGYA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 7 OF MATRIX FGYA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 8 OF MATRIX FGYA

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GENERALIZED GUST FORCE COLUMN 9 OF MATRIX FGYA

.1754[illegible]E+04	0.	.421416E+05	0.	-.471632E+04	0.
0.	0.	0.	0.	-.389178E+02	0.
0.	0.	0.	0.	.707600E+04	0.

GENERALIZED GUST FORCE COLUMN 10 OF MATRIX FGYA

.24605[illegible]+04	0.	.595975E+05	0.	-.666968E+04	0.
0.	0.	0.	0.	-.550380E+02	0.
0.	0.	0.	0.	.100070E+05	0.

GENERALIZED GUST FORCE COLUMN 11 OF MATRIX FGYA

.175402E+04	0.	.421418E+05	0.	-.471632E+04	0.
0.	0.	0.	0.	-.389178E+02	0.
0.	0.	0.	0.	.707600E+04	0.

GENERALIZED GUST FORCE COLUMN 12 OF MATRIX FGYA

.175402E+04	0.	.421418E+05	0.	-.471632E+04	0.
0.	0.	0.	0.	-.389178E+02	0.
0.	0.	0.	0.	.707600E+04	0.

GENERALIZED GUST FORCE COLUMN 13 OF MATRIX FGYA

.175402E+04	0.	.421418E+05	0.	-.471632E+04	0.
0.	0.	0.	0.	-.389178E+02	0.
0.	0.	0.	0.	.707600E+04	0.

MODE 2

STRIP	Y	Z	Y/S	LIFT COEFFICIENT REAL	LIFT COEFFICIENT IMAG.	MOMENT COEFFICIENT 1/4 CHORD OF STRIP REAL	MOMENT COEFFICIENT 1/4 CHORD OF STRIP IMAG.	CENTER OF PRESSURE REAL	CENTER OF PRESSURE IMAG.
1	172.4994	9.2564	.1816	.005870	0.000000	-.000110	-0.000000	.2688	0.0000
2	294.9994	31.7364	.3158	.006529	0.000000	.000113	-0.000000	.2327	0.0000
3	412.5000	51.5750	.4342	.007730	0.000000	-.000305	-0.000000	.2895	0.0000
4	412.5000	51.5750	.4342	.001753	0.000000	-.000118	-0.000000	.3175	0.0000
5	525.0000	71.4140	.5926	.006677	0.000000	-.000053	-0.000000	.2577	0.0000
6	675.0000	97.8620	.7105	.007543	0.000000	-.000017	-0.000000	.2523	0.0000
7	812.5000	122.1160	.8553	.007872	0.000000	.000073	-0.000000	.2407	0.0000
8	912.5000	139.7380	.9605	.006701	0.000000	.000356	-0.000000	.1968	0.0000
9	80.0007	120.1906	.0842	.002432	0.000000	-.000009	-0.000000	.2536	0.0000
10	147.5032	132.0938	.1553	.002458	0.000000	-.000039	-0.000000	.2655	0.0000
11	200.0027	141.3514	.2105	.002543	0.000000	-.000043	-0.000000	.2670	0.0000
12	262.5003	152.3721	.2763	.002719	0.000000	-.000026	-0.000000	.2597	0.0000
13	337.5001	165.5974	.3553	.002650	0.000000	.000060	-0.000000	.2275	0.0000
14	80.0007	120.1906	.0842	.000444	0.000000	-.000027	-0.000000	.3101	0.0000
15	147.5032	132.0938	.1553	.000506	0.000000	-.000029	-0.000000	.3065	0.0000
16	200.0027	141.3514	.2105	.000517	0.000000	-.000028	-0.000000	.3052	0.0000
17	262.5003	152.3721	.2763	.000486	0.000000	-.000024	-0.000000	.3001	0.0000
18	337.5001	165.5974	.3553	.000316	0.000000	-.000015	-0.000000	.2977	0.0000
19	0.0000	165.0005	0.0000	-.000000	0.000000	-.000000	-0.000000	0.0000	0.0000
20	0.0000	200.0009	0.0000	-.000000	0.000000	-.000000	-0.000000	0.0000	0.0000
21	0.0000	360.0008	0.0000	-.000000	0.000000	-.000000	-0.000000	0.0000	0.0000
22	0.0000	430.0004	0.0000	-.000000	0.000000	-.000000	-0.000000	0.0000	0.0000
23	0.0000	165.0005	0.0000	.000000	0.000000	-.000000	-0.000000	0.0000	0.0000
24	0.0000	260.0009	0.0000	.000000	0.000000	-.000000	-0.000000	0.0000	0.0000
25	0.0000	360.0008	0.0000	-.000000	0.000000	-.000000	-0.000000	0.0000	0.0000
26	0.0000	430.0004	0.0000	.000000	0.000000	-.000000	-0.000000	0.0000	0.0000
27	375.0000	22.4800	.3947	-.001751	0.000000	.000083	-0.000000	.2972	0.0000

STATION	SPANWISE COORD.	SPAN LOAD (C*CL)/(C*MAN) REAL	IMAG.
1	172.4994	.71038E-02	0.
2	299.9994	.69955E-02	0.
3	412.5000	.55936E-02	0.
4	525.0000	.569[illegible]E-02	0.
5	675.0000	.50151E-02	0.
6	812.5000	.406[illegible]2E-02	0.
7	912.5000	.27295E-02	0.
8	40.0007	.12354E-02	0.
9	147.5052	.11176E-02	0.
10	200.0027	.10409E-02	0.
11	262.5003	.95955E-03	0.
12	337.5001	.75071E-03	0.
13	165.0005	-.27458E-12	0.
14	260.0009	-.11727E-12	0.
15	360.0008	-.26428E-12	0.
16	430.0004	-.10746E-12	0.
17	22.4800	-.12918E-02	0.

MODE 2

BODY ELEM.	Y	Z	X/L	RUNNING LOAD (VERTICAL) (DF*Z/Q) / DX REAL	IMAG.	RUNNING LOAD (LATERAL) (DF*Y/Q) / DX REAL	IMAG.
1	0.0000	0.0000	.0065	.254829	0.000000	.000000	0.000000
2	0.0000	0.0000	.0327	.290771	0.000000	.000000	0.000000
3	0.0000	0.0000	.0785	.245609	0.000000	.000000	0.000000
4	0.0000	0.0000	.1308	.126391	0.000000	.000000	0.000000
5	0.0000	0.0000	.2027	.097684	0.000000	.000000	0.000000
6	0.0000	0.0000	.2942	.170292	0.000000	.000000	0.000000
7	0.0000	0.0000	.3792	.629511	0.000000	.000000	0.000000
8	0.0000	0.0000	.4576	.841812	0.000000	.000000	0.000000
9	0.0000	0.0000	.5411	.549320	0.000000	.000000	0.000000
10	0.0000	0.0000	.6198	.233524	0.000000	.000000	0.000000
11	0.0000	0.0000	.6878	.039890	0.000000	.000000	0.000000
12	0.0000	0.0000	.7793	-.174110	0.000000	.000000	0.000000
13	0.0000	0.0000	.8760	-.079404	0.000000	.000000	0.000000
14	0.0000	0.0000	.9576	-.131087	0.000000	.000000	0.000000

TOTALS ON BODY 1

F*Z/Q =	.000982	0.000000	M*Z/Q =	-.002015	0.000000
F*Y/Q =	.000000	0.000000	M*Y/Q =	-.000000	0.000000

MODE 2

BODY ELEM.	Y	Z	X/L	RUNNING LOAD (VERTICAL) (DF=Z/Q) / DX REAL	IMAG.	RUNNING LOAD (LATERAL) (DF=Y/Q) / DX REAL	IMAG.
15	375,0000	-55,0000	,0185	,565563	0,000000	,000788	0,000000
16	375,0000	-55,0000	,0741	,290590	0,000000	,005126	0,000000
17	375,0000	-55,0000	,2685	,130962	0,000000	,030368	0,000000
18	375,0000	-55,0000	,5833	,038403	0,000000	,175723	0,000000
19	375,0000	-55,0000	,8704	-,336662	0,000000	,277610	0,000000

TOTALS ON BODY 2

F=Z/Q =	,000006	0,000000	M=Z/Q =	,000033	0,000000
F=Y/Q =	,000091	0,000000	M=Y/Q =	-,000058	0,000000

MODE 2

TOTALS ON LIFTING SURFACES

CZ	=	.007223	0.000000	CY	=	0.000000	0.000000
CM	=	-.001796	0.000000	CN	=	0.000000	0.000000
CBL	=	0.000000	0.000000				

TOTALS ON ENTIRE AIRCRAFT

CZ	=	.008216	0.000000	CY	=	0.000000	0.000000
CM	=	-.000459	0.000000	CN	=	0.000000	0.000000
CBL	=	0.000000	0.000000				

TABLE 28

EXAMPLE PROBLEM OUTPUT LISTING

UNIT LOAD MODULE

```
                                                                      DATE
                                                                      TIME
          FIXED DATA DECK INPUT GO

          IDENT#         6

          THE FOLLOWING ANALYSIS CODES HAVE BEEN CALLED FOR IN THIS RUN

                 UNIT

*******************

TAPE19 REWOUND

*******************
HEADER DATA READ FROM TAPE19
     NK        NSYM       NASYM       NGUST        NB      MACH       REFA       REFB       REFC
     10           7           9          11         2   .85E+00    .91E+06    .95E+03    .50E+03

          INERTIAL DATA

          NO. TOTAL MASSES          =   28
          NO. SYMMETRIC MODES       =    7
          NO. ANTISYMMETRIC MODES   =    9
          NO. ENGINES               =    1
          UNIT LOAD PRNT FLAG       =    0

          RUN DATA DECK INPUT GO

          FLIGHT DATA FOR FREQUENCY RESPONSE AND UNIT GUST LOADS

          VKEAS        =  552.150 KEAS
          ALTITUDE     =   1000.000 FT.
          SIZE FACTOR  =   1.0000 INCHES/UNIT
          VTRUE        =  946.342 FPS
          DYNAMIC P    = 1033.536 PSF
          SIGMA        =   .97106E+00
          MACH         =    .8506
          PLOT 3 FLG   =    0
          PLOT GST FLG=     2

               3127 WORDS OF CORE RQD FOR STEP ***  MAIN    ***
```

DATE
TIME

MASS AND MASS POINT GEOMETRY

I	EM(I)	ELXIO(I)	ELYIO(I)	ELZIO(I)
1	.235113E+02	.123003E+03	-0.	-0.
2	.271550E+02	.317000E+03	-0.	-0.
3	.214750E+02	.453000E+03	-0.	-0.
4	.364530E+02	.625000E+03	-0.	-0.
5	.111912E+03	.950000E+03	-0.	-0.
6	.673220E+02	.133000E+04	-0.	-0.
7	.279310E+02	.155000E+04	-0.	-0.
8	.104161E+02	.173000E+04	-0.	-0.
9	.172580E+02	.183000E+04	-0.	-0.
10	.231550E+02	.904240E+03	.150000E+03	.529000E+01
11	.418800E+02	.941712E+03	.250000E+03	.229200E+02
12	.295420E+02	.101105E+04	.375000E+03	.449600E+02
13	.135280E+02	.107412E+04	.550000E+03	.751200E+02
14	.140280E+02	.110555E+04	.770000E+03	.102271E+03
15	.502300E+01	.123655E+04	.850000E+03	.124720E+03
16	.529000E+00	[illegible]	.950000E+03	.146350E+03
17	.207210E+02	.700000E+03	.375000E+03	-.550000E+02
18	.116550E+02	.850000E+03	.375000E+03	-.550000E+02
19	.630700E+01	.179117E+04	.100000E+03	.123720E+03
20	.338700E+01	.181331E+04	.225000E+03	.145760E+03
21	.570000E+00	.187610E+04	.375000E+03	.172210E+03
22	.385900E+01	.167317E+04	0.	.175000E+03
23	.220200E+01	.175550E+04	0.	.300000E+03
24	.642100E+00	.185430E+04	0.	.450000E+03
25	.196000E+00	.119000E+04	.375000E+03	.449600E+02
26	.196000E+00	.121145E+04	.450000E+03	.581900E+02
27	.103000E+01	.190860E+04	.225000E+03	.145760E+03
28	.148000E+01	.187758E+04	0.	.310000E+03

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 1

WR(1) = 0.

I	PHIX(I, 1)	PHIY(I, 1)	PHIZ(I, 1)
1	0.	0.	-.100000E+01
2	0.	0.	-.100000E+01
3	0.	0.	-.100000E+01
4	0.	0.	-.100000E+01
5	0.	0.	-.100000E+01
6	0.	0.	-.100000E+01
7	0.	0.	-.100000E+01
8	0.	0.	-.100000E+01
9	0.	0.	-.100000E+01
10	.735400E-01	-.157300E+00	-.984800E+00
11	.735400E-01	-.157300E+00	-.984800E+00
12	.735400E-01	-.157300E+00	-.984800E+00
13	.735400E-01	-.157300E+00	-.984800E+00
14	.735400E-01	-.157300E+00	-.984800E+00
15	.735400E-01	-.157300E+00	-.984800E+00
16	.735400E-01	-.157300E+00	-.984800E+00
17	0.	0.	-.100000E+01
18	0.	0.	-.100000E+01
19	.660900E-01	-.160600E+00	-.984800E+00
20	.660900E-01	-.160600E+00	-.984800E+00
21	.660900E-01	-.160600E+00	-.984800E+00
22	.549400E+00	0.	-.835500E+00
23	.549400E+00	0.	-.835500E+00
24	.549400E+00	0.	-.835500E+00
25	.735400E-01	-.157300E+00	-.984800E+00
26	.735400E-01	-.157300E+00	-.984800E+00
27	.660900E-01	-.160600E+00	-.984800E+00
28	.549400E+00	0.	-.835500E+00

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 2

WR(2) = 0.

I	PHIX(I, 2)	PHIY(I, 2)	PHIZ(I, 2)
1	0.	0.	.880000E+00
2	0.	0.	.700000E+00
3	0.	0.	.550000E+00
4	0.	0.	.375000E+00
5	0.	0.	.500000E-01
6	0.	0.	-.300000E+00
7	.300000E-01	0.	-.550000E+00
8	.570000E-01	0.	-.700000E+00
9	.750000E-01	0.	-.800000E+00
10	-.225300E-02	.173000E-01	.943100E-01
11	.172100E-01	.173000E-01	.475600E-01
12	.415400E-01	.173000E-01	-.108800E-01
13	.756100E-01	.173000E-01	-.926900E-01
14	.104800E+00	.173000E-01	-.182800E+00
15	.134000E+00	.173000E-01	-.232900E+00

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 2

WR(2) = 0.

I	PHIX(I, 2)	PHIY(I, 2)	PHIZ(I, 2)
16	.153500E+00	.173000E-01	-.279700E+00
17	-.550000E-01	0.	.300000E+00
18	-.550000E-01	0.	.150000E+00
19	.164800E+00	-.750900E-01	-.749500E+00
20	.188500E+00	-.751300E-01	-.801000E+00
21	.217100E+00	-.751300E-01	-.862700E+00
22	.516100E+00	0.	-.466300E+00
23	.665700E+00	0.	-.466300E+00
24	.845200E+00	0.	-.466300E+00
25	.547500E-01	-.109500E-01	-.187800E+00
26	.682600E-01	-.801900E-02	-.208200E+00
27	.194800E+00	-.904400E-01	-.694900E+00
28	.741200E+00	0.	-.562900E+00

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 3

WR(3) = 0.

I	PHIX(I, 3)	PHIY(I, 3)	PHIZ(I, 3)
1	-.100000E+01	0.	0.
2	-.100000E+01	0.	0.
3	-.100000E+01	0.	0.
4	-.100000E+01	0.	0.
5	-.100000E+01	0.	0.
6	-.100000E+01	0.	0.
7	-.100000E+01	0.	0.
8	-.100000E+01	0.	0.
9	-.100000E+01	0.	0.
10	-.905900E+00	-.423500E+00	0.
11	-.905900E+00	-.423500E+00	0.
12	-.905900E+00	-.423500E+00	0.
13	-.905900E+00	-.423500E+00	0.
14	-.905900E+00	-.423500E+00	0.
15	-.905900E+00	-.423500E+00	0.
16	-.905900E+00	-.423500E+00	0.
17	-.100000E+01	0.	0.
18	-.100000E+01	0.	0.
19	-.924700E+00	-.380600E+00	0.
20	-.924700E+00	-.380600E+00	0.
21	-.924700E+00	-.380600E+00	0.
22	-.835500E+00	0.	-.549400E+00
23	-.835500E+00	0.	-.549400E+00
24	-.835500E+00	0.	-.549400E+00
25	-.905900E+00	-.423500E+00	0.
26	-.905900E+00	-.423500E+00	0.
27	-.924700E+00	-.380600E+00	0.
28	-.835500E+00	0.	-.549400E+00

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 4

WR(4) = .1000E+04

I	PHIX(I, 4)	PHIY(I, 4)	PHIZ(I, 4)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 4

WR(4) = .1000E+02

I	PHIX(I, 4)	PHIY(I, 4)	PHIZ(I, 4)
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	0.	-0.	-0.
20	0.	-0.	-0.
21	0.	-0.	-0.
22	0.	-0.	-0.
23	0.	-0.	-0.
24	0.	-0.	-0.
25	0.	-0.	-0.
26	0.	-0.	-0.
27	-0.	-0.	-.395050E-01
28	0.	-0.	-0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 5

WR(5) = .2000E+01

I	PHIX(I, 5)	PHIY(I, 5)	PHIZ(I, 5)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	-0.	-0.	.305000E-01
11	-0.	-0.	.132000E+00
12	-0.	-0.	.258900E+00
13	-0.	-0.	.436600E+00
14	-0.	-0.	.588900E+00
15	-0.	-0.	.741300E+00
16	-0.	-0.	.842800E+00
17	-0.	-0.	.860900E+00
18	-0.	-0.	.860900E+00
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 5

WR(5) = .2000E+01

I	PHIX(I, 5)	PHIY(I, 5)	PHIZ(I, 5)
24	0.	0.	0.
25	-0.	-0.	.258900E+00
26	-0.	-0.	.335100E+00
27	0.	0.	0.
28	0.	0.	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 6

WR(6) = .4000E+01

I	PHIX(I, 6)	PHIY(I, 6)	PHIZ(I, 6)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	-0.	-0.	.609000E-01
20	-0.	-0.	.187900E+00
21	-0.	-0.	.340200E+00
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	-0.	-0.	.187900E+00
28	0.	0.	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 7

WR(7) = .3000E+01

I	PHIX(I, 7)	PHIY(I, 7)	PHIZ(I, 7)
1	0.	0.	-.880000E+00
2	0.	0.	-.700000E+00
3	0.	0.	-.550000E+00
4	0.	0.	-.375000E+00
5	0.	0.	-.500000E-01
6	-0.	-0.	-.300000E+00
7	-0.	-0.	-.550000E+00
8	-0.	-0.	-.700000E+00
9	-0.	-0.	-.800000E+00
10	0.	0.	0.
11	0.	0.	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 7

WR(7) = .3000E+01

I	PHIX(I, 7)	PHIY(I, 7)	PHIZ(I, 7)
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	[illegible]E+00	-.752[illegible]E-01	-.7[illegible]E+00
20	[illegible]E+00	-.[illegible]E-01	-.801[illegible]E+00
21	.2255[illegible]E+00	-.752000E-01	-.8827[illegible]E+00
22	.916100E+00	0.	-.188300E+00
23	.865700E+00	0.	-.488300E+00
24	.845200E+00	0.	-.488300E+00
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	-.894900E+00
28	0.	0.	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 8

WR(8) = 0.

I	PHIX(I, 8)	PHIY(I, 8)	PHIZ(I, 8)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	.3[illegible]E-01	0.
8	0.	.570000E-01	0.
9	0.	.75[illegible]E-01	0.
10	.882500E-02	-.1[illegible]E-01	-.148600E+00
11	.882500E-02	-.188800E-01	-.250200E+00
12	.882500E-02	-.188[illegible]E-01	-.377100E+00
13	.882500E-02	-.188[illegible]E-01	-.554800E+00
14	.882500E-02	-.188600E-01	-.707100E+00
15	.882500E-02	-.188300E-01	-.859400E+00
16	.882500E-02	-.188500E-01	-.961000E+00
17	0.	-.550000E-01	-.375000E+00
18	0.	-.550000E-01	-.175000E+00
19	-.398000E-01	.967000E-01	-.120000E+00
20	-.397600E-01	.958100E-01	-.246900E+00
21	-.397600E-01	.966100E-01	-.399200E+00
22	0.	.175000E+00	0.
23	0.	.300000E+00	0.
24	0.	.450000E+00	0.
25	.882600E-02	-.188600E-01	-.377100E+00
26	.882400E-02	-.188700E-01	-.453300E+00
27	-.397600E-01	.966100E-01	-.246900E+00
28	0.	.310000E+00	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 9

WR(9) = 0.

I	PHIX(I, 9)	PHIY(I, 9)	PHIZ(I, 9)

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 9

WR(9) = 0.

I	PHIX(I, 9)	PHIY(I, 9)	PHIZ(I, 9)
1	0.	-.840[illegible]0E+00	0.
2	0.	-.720[illegible]E+00	0.
3	0.	-.553[illegible]E+00	0.
4	0.	-.375[illegible]E+00	0.
5	0.	-.5[illegible]E-01	0.
6	0.	.3[illegible]E+00	0.
7	0.	.553[illegible]E+00	0.
8	0.	.72[illegible]E+00	0.
9	0.	.840[illegible]E+00	0.
10	-.959500E-01	-.149[illegible]E+00	.165500E-01
11	-.2[illegible]300E+00	-.149000E+00	.838500E-02
12	-.344300E+00	-.149000E+00	-.191900E-02
13	-.537500E+00	-.149000E+00	-.163400E-01
14	-.703100E+00	-.149000E+00	-.257100E-01
15	-.862700E+00	-.149000E+00	-.410700E-01
16	-.979000E+00	-.149[illegible]E+00	-.493200E-01
17	-.379000E+00	-.300000E+00	0.
18	-.375000E+00	-.150000E+00	0.
19	-.377700E+00	.635000E+00	-.132200E+00
20	-.512700E+00	.655000E+00	-.141200E+00
21	-.675100E+00	.635[illegible]E+00	-.152100E+00
22	0.	.673200E+00	0.
23	0.	.755400E+00	0.
24	0.	.854[illegible]E+00	0.
25	-.419200E+00	.112800E-01	-.331100E-01
26	-.495800E+00	-.143100E-02	-.367200E-01
27	-.548600E+00	.741900E+00	-.157800E+00
28	0.	.877600E+00	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 10

WR(10) = 0.

I	PHIX(I,10)	PHIY(I,10)	PHIZ(I,10)
1	0.	.100000E+01	0.
2	0.	.100000E+01	0.
3	0.	.100000E+01	0.
4	0.	.100000E+01	0.
5	0.	.100000E+01	0.
6	0.	.100000E+01	0.
7	0.	.100000E+01	0.
8	0.	.100000E+01	0.
9	0.	.100000E+01	0.
10	-.417100E+00	.892100E+00	-.173600E+00
11	-.417100E+00	.892100E+00	-.173600E+00
12	-.417100E+00	.892100E+00	-.173600E+00
13	-.417100E+00	.892100E+00	-.173600E+00
14	-.417100E+00	.892100E+00	-.173600E+00
15	-.417100E+00	.892100E+00	-.173600E+00
16	-.417100E+00	.892100E+00	-.173600E+00
17	0.	.100000E+01	0.
18	0.	.100000E+01	0.
19	-.374800E+00	.910700E+00	-.173600E+00
20	-.374800E+00	.910700E+00	-.173600E+00

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 10

WR(10) = 0.

I	PHIX(I,10)	PHIY(I,10)	PHIZ(I,10)
21	-.374800E+00	.910700E+00	-.173600E+00
22	0.	.100000E+01	0.
23	0.	.100000E+01	0.
24	0.	.100000E+01	0.
25	-.417100E+00	.892100E+00	-.173600E+00
26	-.417100E+00	.892100E+00	-.173600E+00
27	-.374800E+00	.910700E+00	-.173600E+00
28	0.	.100000E+01	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 11

WR(11) = .1000E+02

I	PHIX(I,11)	PHIY(I,11)	PHIZ(I,11)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	0.	-0.	-0.
20	0.	-0.	-0.
21	0.	-0.	-0.
22	0.	-0.	-0.
23	0.	-0.	-0.
24	0.	-0.	-0.
25	0.	-0.	-0.
26	0.	-0.	-0.
27	0.	-0.	-0.
28	-0.	-.521550E-01	-0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 12

WR(12) = .1000E+02

I	PHIX(I,12)	PHIY(I,12)	PHIZ(I,12)
1	0.	-0.	-0.
2	0.	-0.	-0.
3	0.	-0.	-0.
4	0.	-0.	-0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	-0.	-0.
8	0.	-0.	-0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 12

WR(12) = .1000E+02

I	PHIX(I,12)	PHIY(I,12)	PHIZ(I,12)
9	0.	-0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	0.	-0.	-0.
13	0.	-0.	-0.
14	0.	-0.	-0.
15	0.	-0.	-0.
16	0.	-0.	-0.
17	0.	-0.	-0.
18	0.	-0.	-0.
19	0.	-0.	-0.
20	0.	-0.	-0.
21	0.	-0.	-0.
22	0.	-0.	-0.
23	0.	-0.	-0.
24	0.	-0.	-0.
25	-0.	-0.	-.711970E-01
26	-0.	-0.	-.653540E-01
27	0.	-0.	-0.
28	0.	-0.	-0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 13

WR(13) = .20[illegible]E+01

I	PHIX(I,13)	PHIY(I,13)	PHIZ(I,13)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	-0.	-0.	.305000E-01
11	-0.	-0.	.132000E+00
12	-0.	-0.	.25[illegible]E+00
13	-0.	-0.	.436600E+00
14	-0.	-0.	.588900E+00
15	-0.	-0.	.741300E+00
16	-0.	-0.	.942800E+00
17	-0.	-0.	.260900E+00
18	-0.	-0.	.260900E+00
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	-0.	-0.	.258900E+00
26	-0.	-0.	.335100E+00
27	0.	0.	0.
28	0.	0.	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 14

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 14

WR(14) = .4000E+01

I	PHIX(I,14)	PHIY(I,14)	PHIZ(I,14)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	-0.	-0.	.609000E-01
20	-0.	-0.	.187900E+00
21	-0.	-0.	.340200E+00
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	-0.	-0.	.187900E+00
28	0.	0.	0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 15

WR(15) = .4000E+01

I	PHIX(I,15)	PHIY(I,15)	PHIZ(I,15)
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.

DATE
TIME

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 15

W(15) = .6000E+01

I	PHIX(I,15)	PHIY(I,15)	PHIZ(I,15)
21	0.	0.	0.
22	-0.	.550000E-01	-0.
23	-0.	.150000E+00	-0.
24	-0.	.350000E+00	-0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	-0.	.170000E+00	-0.

FREQUENCY AND INERTIAL MODE SHAPES FOR MODE 16

W(16) = .2900E+01

I	PHIX(I,16)	PHIY(I,16)	PHIZ(I,16)
1	0.	-.88[illegible]E+00	0.
2	0.	-.7[illegible]E+00	0.
3	0.	-.[illegible]5[illegible]E+00	0.
4	0.	-.375000E+00	0.
5	0.	-.500000E-01	0.
6	-0.	-.300000E+00	-0.
7	-0.	-.550000E+00	-0.
8	-0.	-.700000E+00	-0.
9	-0.	-.800000E+00	-0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
19	0.	0.	0.
19	.377700E+00	-.655000E+00	.132200E+00
20	.512900E+00	-.655000E+00	.141200E+00
21	.675100E+00	-.655000E+00	.152100E+00
22	0.	-.673200E+00	-0.
23	0.	-.755400E+00	-0.
24	0.	-.854000E+00	-0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	-.977600E+00	-0.

```
                                                                  DATE
                                                                  TIME
SYMMETRIC MODE LOCATION DEFINITION

RIGID BODY PLUNGE            MODE  1
RIGID BODY PITCH             MODE  2
RIGID BODY FORE AND AFT      MODE  3
FIRST SYMMETRIC ELASTIC      MODE  5
LAST  SYMMETRIC ELASTIC      MODE  7
SYMMETRIC FLIGHT TRIM        MODE  4
SYMMETRIC AIRCRAFT JIG       MODE  0
FIRST DELETED SYMMETRIC      MODE  0
LAST  DELETED SYMMETRIC      MODE  0

ANTISYMMETRIC MODE LOCATION DEFINITION

RIGID BODY ROLL              MODE  8
RIGID BODY YAW               MODE  9
RIGID BODY LATERAL           MODE 10
FIRST ANTISYM. ELASTIC       MODE 13
LAST  ANTISYM. ELASTIC       MODE 16
ROLL TRIM                    MODE 12
YAW  TRIM                    MODE 11
ANTISYM AIRCRAFT JIG         MODE  0
FIRST DELETED ANTISYM        MODE  0
LAST  DELETED ANTISYM        MODE  0

 I    CPYCRG(I)
 1 0.
 2 0.
 3 0.
 4  .300000E=01
 5  .300000E=01
 6  .300000E=01
 7  .300000E=01
 8 0.
 9 0.
10 0.
11  .300000E=01
12  .300000E=01
13  .300000E=01
14  .300000E=01
15  .300000E=01
16  .300000E=01
```

DATE
TIME

GENERALIZED MASS MATRIX

	1	2	3	4	5	6	7	8
1	.35309E+03	-.30906E+00	0.	.40072E+01	-.40097E+02	-.14981E+01	.78450E+02	0.
2	-.30906E+00	.53139E+02	-.79788E+01	.36414E-01	-.55681E+00	-.12288E+01	.42970E+01	0.
3	0.	-.79788E+01	.35310E+03	0.	0.	0.	-.23363E+01	0.
4	.40072E+01	.36414E-01	0.	.16075E-02	0.	-.76457E-02	.36414E-01	0.
5	-.40097E+02	-.55681E+00	0.	0.	.15403E+02	0.	0.	0.
6	-.14981E+01	-.12288E+01	0.	-.76457E-02	0.	.26657E+00	-.12288E+01	0.
7	.78450E+02	.42970E+01	-.23363E+01	.36414E-01	0.	-.12288E+01	.48626E+02	0.
8	0.	0.	0.	0.	0.	0.	0.	.24264E+02
9	0.	0.	0.	0.	0.	0.	0.	.40603E+01
10	0.	0.	0.	0.	0.	0.	0.	.79767E+01
11	0.	0.	0.	0.	0.	0.	0.	-.11984E-01
12	0.	0.	0.	0.	0.	0.	0.	.11069E-01
13	0.	0.	0.	0.	0.	0.	0.	-.20165E+02
14	0.	0.	0.	0.	0.	0.	0.	-.35636E+00
15	0.	0.	0.	0.	0.	0.	0.	.16924E+00
16	0.	0.	0.	0.	0.	0.	0.	-.56245E+01

	9	10	11	12	13	14	15	16
1	0.	0.	0.	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	0.	0.	0.	0.
4	0.	0.	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.	0.	0.	0.
6	0.	0.	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	0.	0.	0.	0.
8	.40603E+01	.79767E+01	-.11984E-01	.11069E-01	-.20165E+02	-.35636E+00	.16924E+00	-.56245E+01
9	.79235E+02	-.51234E+00	-.33871E-01	.93240E-03	-.46109E+00	-.21666E+00	.43550E+00	-.39527E+01
10	-.51234E+00	.35530E+03	-.38595E-01	.46462E-02	-.55793E+01	-.26408E+00	.55063E+00	-.78187E+02
11	-.33871E-01	-.38595E-01	.20129E-02	0.	0.	0.	-.73330E-02	.33871E-01
12	.93240E-03	.46462E-02	0.	.16307E-02	-.79053E-02	0.	0.	0.
13	-.46109E+00	-.55793E+01	0.	-.79053E-02	.15403E+02	0.	0.	0.
14	-.21666E+00	-.26408E+00	0.	0.	0.	.26657E+00	0.	.18612E+00
15	.43550E+00	.55063E+00	-.73330E-02	0.	0.	0.	.10118E+00	-.43500E+00
16	-.39527E+01	-.78187E+02	.33871E-01	0.	0.	.18612E+00	-.43500E+00	.48209E+02

GENERALIZED STIFFNESS MATRIX

	1
1	0.
2	0.
3	0.
4	.63460E+01
5	.24323E+04

DATE
TIME

GENERALIZED STIFFNESS MATRIX

	1
6	.16839E+03
7	.17277E+05
8	0.
9	0.
10	0.
11	.79466E+01
12	.72272E+01
13	.24321E+04
14	.16839E+03
15	.65174E+02
16	.11910E+05

DATE
TIME

UNIT LOAD DATA

NO. INTGD LOAD BEAMS = 14
NO. INTGD LOADS DEFINED = 10
NO. STRESSES = 0
NO. MASS GROUPS = 13
NO. AERO BOX GROUPS = 5
NO. SLENDER BODY GROUPS = 6

****

TAPE19 REWOUND

****
HEADER DATA READ FROM TAPE19

NK	NSYM	NASYM	NGUST	NB	MACH	REFA	REFS	REFC
16	7	9	13	2	.85E+00	.41E+06	.95E+03	.30E+03

DATE
TIME

UNIT LOAD MODULE ANALYSIS

BRANCH

	1	2	3	4	5	6	7
1	.89000E+03	.14000E+03	0.	.10111E+04	.37500E+03	.44960E+02	.10000E+01
2	.10111E+04	.37500E+03	.44960E+02	.12840E+04	.95000E+03	.14635E+03	.10000E+01
3	.10111E+04	.37500E+03	.44960E+02	.87000E+03	.37500E+03	0.	.40000E+01
4	.89000E+03	0.	0.	.89000E+03	.12000E+03	0.	.17000E+01
5	.89000E+03	0.	0.	0.	0.	0.	.20000E+01
6	.89000E+03	0.	0.	.13800E+04	0.	0.	.20000E+01
7	.13300E+04	0.	0.	.16370E+04	0.	.45890E+02	.20000E+01
8	.17360E+04	0.	.63570E+02	.17360E+04	0.	.11314E+03	.10000E+01
9	.17360E+04	.40000E+02	.11314E+03	.18760E+04	.37500E+03	.17221E+03	.10000E+01
10	.16370E+04	0.	.45890E+02	.16370E+04	0.	.12000E+03	.30000E+01
11	.16370E+04	0.	.12000E+03	.18540E+04	0.	.45000E+03	.30000E+01
12	.16370E+04	0.	.45890E+02	.17360E+04	0.	.63570E+02	.20000E+01
13	.17360E+04	0.	.63570E+02	.19120E+04	0.	.95000E+02	.20000E+01
14	.17360E+04	0.	.11314E+03	.17360E+04	.40000E+02	.11314E+03	.10000E+01

STALDS

	1	2	3	4	5	6	7	8
1	.40000E+01	.40000E+01	.10000E+01	.89000E+03	.12000E+03	0.	.10000E+06	-.10000E+06
2	.40000E+01	.10000E+01	.10000E+01	.89000E+03	.12000E+03	0.	.17140E+11	-.14460E+11
3	.50000E+01	.60000E+01	.20000E+01	.89000E+03	0.	0.	.75000E+04	-.75000E+04
4	.60000E+01	.60000E+01	.20000E+01	.89000E+03	0.	0.	.15000E+06	-.15000E+06
5	.14000E+02	.40000E+01	.10000E+01	.17360E+04	.40000E+02	.11314E+03	.80000E+05	-.80000E+05
6	.10000E+02	.40000E+01	.30000E+01	.16370E+04	0.	.12000E+03	.75000E+04	-.75000E+04
7	.10000E+01	.40000E+01	.10000E+01	.10111E+04	.37500E+03	.44960E+02	.50000E+05	-.50000E+05
8	.20000E+01	.40000E+01	.10000E+01	.10111E+04	.37500E+03	.44960E+02	.10000E+06	-.10000E+06
9	.30000E+01	.40000E+01	.40000E+01	.85000E+03	.37500E+03	-.55000E+02	.10000E+07	-.10000E+07
10	.80000E+01	.40000E+01	.20000E+01	.89000E+03	0.	0.	.10000E+11	-.10000E+11

NEWLMB

	1	2	3	4	5	6	7	8
1	.10000E+01	.50000E+01	.70000E+01	.80000E+01	.90000E+01	.10000E+02	.13000E+02	.17000E+02
2	.40000E+01	.60000E+01	.70000E+01	.90000E+01	.90000E+01	.12000E+02	.16000E+02	.16000E+02
3	.50000E+01	.60000E+01	.70000E+01	.12000E+02	.13000E+02	.10000E+01	.20000E+01	.30000E+01

DATE
TIME

VPNLMA

	9	10	11	12	13
1	.19000E+02	.22[illegible]+02	.25000E+02	.27000E+02	.28000E+02
2	.21000E+02	.24[illegible]+02	.26000E+02	.27000E+02	.28000E+02
3	.90000E+01	.11000E+02	.2[illegible]E+01	.90000E+01	.11000E+02

MASS GROUP = 1

LAMV

	1	2	3
1	.10000E+01	=0.	=0.
2	=0.	.10000E+01	=0.
3	=0.	=0.	.10000E+01

MASS GROUP = 2

LAMV

	1	2	3
1	.10000E+01	=0.	=0.
2	=0.	.10000E+01	=0.
3	=0.	=0.	.10000E+01

MASS GROUP = 3

LAMV

	1	2	3
1	.10000E+01	=0.	=0.
2	=0.	.10000E+01	=0.
3	=0.	=0.	.10000E+01

MASS GROUP = 4

LAMV

	1	2	3
1	.10000E+01	=0.	=0.
2	=0.	.10000E+01	=0.
3	=0.	=0.	.10000E+01

MASS GROUP = 5

DATE
TIME

LAMV

	1	2	3
1	.10000E+01	-0.	-0.
2	-0.	.10000E+01	-0.
3	-0.	-0.	.10000E+01

MASS GROUP = 6

LAMV

	1	2	3
1	.90590E+00	.42350E+00	-0.
2	-.41710E+00	.89210E+00	-.17360E+00
3	-.73500E-01	.15730E+00	.98480E+00

MASS GROUP = 7

LAMV

	1	2	3
1	.90590E+00	.42350E+00	-0.
2	.41710E+00	.89210E+00	-.17360E+00
3	-.73500E-01	.15730E+00	.98480E+00

MASS GROUP = 8

LAMV

	1	2	3
1	.10000E+01	-0.	-0.
2	-0.	.10000E+01	-0.
3	-0.	-0.	.10000E+01

MASS GROUP = 9

LAMV

	1	2	3
1	.92470E+00	.38060E+00	-0.
2	-.37180E+00	.91070E+00	-.17360E+00
3	-.66100E-01	.16060E+00	.98480E+00

MASS GROUP = 10

DATE
TIME

LAMV

	1	2	3
1	.83550E+00	-0.	.54940E+00
2	-0.	.10000E+01	-0.
3	-.54940E+00	-0.	.83550E+00

MASS GROUP = 11

LAMV

	1	2	3
1	.90590E+00	.42350E+00	-0.
2	-.41710E+00	.89210E+00	-.17360E+00
3	-.73500E-01	.15730E+00	.98480E+00

MASS GROUP = 12

LAMV

	1	2	3
1	.92470E+00	.38060E+00	-0.
2	-.37480E+00	.91070E+00	-.17360E+00
3	-.66100E-01	.16060E+00	.98480E+00

MASS GROUP = 13

LAMV

	1	2	3
1	.83550E+00	-0.	.54940E+00
2	-0.	.10000E+01	-0.
3	-.54940E+00	-0.	.83550E+00

NPNLAB

	1	2	3	4	5
1	.10000E+01	.17000E+02	.57000E+02	.87000E+02	.11100E+03
2	.16000E+02	.56000E+02	.86000E+02	.11000E+03	.11600E+03
3	.10000E+01	.20000E+01	.90000E+01	.11000E+02	.30000E+01

DATE
TIME

NFNLSB

	1	2	3	4	5	6
1	.10000E+01	.90000E+01	.12000E+02	.13000E+02	.14000E+02	.15000E+02
2	.80000E+01	.11000E+02	.12000E+02	.13000E+02	.14000E+02	.19000E+02
3	.50000E+01	.60000E+01	.70000E+01	.12000E+02	.13000E+02	.30000E+01

ENGW

	1	2
1	.17000E+02	.18000E+02

HEADER DATA WRITTEN ON TAPE34

IDENT	NINTLD	NSTNSS	NENGS	NSYM	NASYM	NK	NABGRP	NSBGRP	NBOXES	NAERSB
6	10	0	1	7	9	10	5	6	40	8

BEAM LOAD DIST DEFINITION

BEAM	COSDIM	SINDIM	COSBMP	SINBMP	BEAMS LOADED BY NO,
1	,984810	,173636	,905895	,423502	1 4
2	,984807	,173651	,905899	,423493	2 1 4
3	0,000000	=1,000000	,208355	=,978053	3 1 4
4	1,000000	0,000000	1,000000	0,000000	4
5	0,000000	1,000000	0,000000	=1,000000	5
6	0,000000	1,000000	0,000000	1,000000	6
7	0,000000	1,000000	,175780	,984429	7 6
8	0,000000	1,000000	1,000000	0,000000	8 12 7 6
9	,984808	,173649	,924744	,380589	9 14 8 12 7 6
10	0,000000	1,000000	1,000000	0,000000	10 7 6
11	0,000000	1,000000	,835539	,549430	11 10 7 6
12	0,000000	1,000000	,175804	,984425	12 7 6
13	0,000000	1,000000	,175798	,984426	13 12 7 6
14	1,000000	0,000000	1,000000	0,000000	14 8 12 7 6

T_{LAMY}

	1	2	3	4	5	6	7	8
1	,42350E+00	,42349E+00	=,97805E+00	0,	=,10000E+01	,10000E+01	,98443E+00	0,
2	,89213E+00	,89214E+00	0,	,10000E+01	0,	0,	0,	0,
3	,15730E+00	,15731E+00	=,20835E+00	0,	0,	0,	,17578E+00	,10000E+01
4	=,48397E+03	=,76980E+03	,99823E+03	=0,	,89000E+03	=,89000E+03	=,13585E+04	=,63570E+02

	9	10	11	12	13	14
1	,38059E+00	0,	,54943E+00	,98443E+00	,98443E+00	0,
2	,91073E+00	0,	0,	0,	0,	,10000E+01
3	,16095E+00	,10000E+01	,83554E+00	,17580E+00	,17580E+00	0,
4	=,71530E+03	=,45890E+02	=,99968E+03	=,16196E+04	=,17201E+04	=0,

NBEAMB 1

T_{LAMM}

	1	2	3
1	,90590E+00	=,41707E+00	=,73535E-01
2	,42350E+00	,89213E+00	,15730E+00
3	0,	=,17364E+00	,98481E+00

NBEAMB 2

DATE
TIME

TLAMM

	1	2	3
1	.90590E+00	-.41708E+00	-.73540E-01
2	.42340E+00	.89214E+00	.15731E+00
3	0.	-.17365E+00	.98481E+00

NREAMB 3

TLAMM

	1	2	3
1	.20835E+00	-0.	-.97805E+00
2	-.97805E+00	0.	-.20835E+00
3	0.	.10000E+01	0.

NREAMB 4

TLAMM

	1	2	3
1	.10000E+01	-0.	-0.
2	0.	.10000E+01	0.
3	0.	-0.	.10000E+01

NREAMB 5

TLAMM

	1	2	3
1	0.	-0.	.10000E+01
2	-.10000E+01	0.	0.
3	0.	-.10000E+01	0.

NREAMB 6

DATE
TIME

T_LAMM

	1	2	3
1	0.	-0.	-.10000E+01
2	.10000E+01	0.	0.
3	0.	-.10000E+01	0.

NBEAM= 7

T_LAMM

	1	2	3
1	.17578E+00	-0.	-.98443E+00
2	.98443E+00	0.	.17578E+00
3	0.	-.10000E+01	0.

NBEAM= 8

T_LAMM

	1	2	3
1	.10000E+01	-0.	-0.
2	0.	0.	.10000E+01
3	0.	-.10000E+01	0.

NBEAM= 9

T_LAMM

	1	2	3
1	.92474E+00	-.37481E+00	-.66089E-01
2	.38050E+00	.91070E+00	.16058E+00
3	0.	-.17365E+00	.98481E+00

NBEAM= 10

DATE
TIME

TLAMM

	1	2	3
1	.10000E+01	-0.	-0.
2	0.	0.	.10000E+01
3	0.	-.10000E+01	0.

NBEAM= 11

TLAMM

	1	2	3
1	.83554E+00	-0.	-.54943E+00
2	.54943E+00	0.	.83554E+00
3	0.	-.10000E+01	0.

NBEAM= 12

TLAMM

	1	2	3
1	.17580E+00	-0.	-.98443E+00
2	.98443E+00	0.	.17580E+00
3	0.	-.10000E+01	0.

NBEAM= 13

TLAMM

	1	2	3
1	.17580E+00	-0.	-.98443E+00
2	.98443E+00	0.	.17580E+00
3	0.	-.10000E+01	0.

NBEAM= 14

DATE
TIME

TLAMM

	1	2	3
1	.10000E+01	-0.	-0.
2	0.	.10000E+01	0.
3	0.	-0.	.10000E+01

5026 WORDS OF CORE RQD FOR STEP ***UNITLOAD ***

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 1 MASS 1 TO 4

MASS	X	Y	Z
1	.120000E+03	-0.	-0.
2	.300000E+03	-0.	-0.
3	.450000E+03	-0.	-0.
4	.625000E+03	-0.	-0.

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 2 MASS 5 TO 6

MASS	X	Y	Z
5	.950000E+03	-0.	-0.
6	.130000E+04	-0.	-0.

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 3 MASS 7 TO 7

MASS	X	Y	Z
7	.159000E+04	-0.	-0.

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 4 MASS 8 TO 8

MASS	X	Y	Z
8	.170000E+04	-0.	-0.

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 5 MASS 9 TO 9

MASS	X	Y	Z
9	.180000E+04	-0.	-0.

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 6 MASS 10 TO 12

MASS	X	Y	Z
10	.904240E+03	.150000E+03	.529000E+01
11	.951710E+03	.250000E+03	.229200E+02
12	.101109E+04	.375000E+03	.449600E+02

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 7 MASS 13 TO 16

MASS	X	Y	Z
13	.109412E+04	.550000E+03	.758200E+02
14	.114533E+04	.700000E+03	.102270E+03
15	.121653E+04	.850000E+03	.128720E+03
16	.128400E+04	.950000E+03	.146350E+03

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 8 MASS 17 TO 18

MASS	X	Y	Z
17	.700000E+03	.375000E+03	-.550000E+02
18	.850000E+03	.375000E+03	-.550000E+02

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 9 MASS 19 TO 21

MASS	X	Y	Z
19	.176107E+04	.100000E+03	.123720E+03
20	.181333E+04	.225000E+03	.148760E+03
21	.187600E+04	.375000E+03	.172210E+03

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 10 MASS 22 TO 24

MASS	X	Y	Z
22	.167117E+04	0.	.175000E+03
23	.179536E+04	0.	.300000E+03
24	.185400E+04	0.	.450000E+03

INERTIAL LOAD DATA

GEOMETRY FOR MASS GROUP 11 MASS 25 TO 26

MASS	X	Y	Z
25	.119066E+04	.375000E+03	.449600E+02
26	.121145E+04	.450000E+03	.581900E+02

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                    INERTIAL LOAD DATA

                    GEOMETRY FOR MASS GROUP  12 MASS  27 TO  27

MASS      X              Y              Z
  27   .190866E+04    .225000E+03    .145700E+03




                    INERTIAL LOAD DATA

                    GEOMETRY FOR MASS GROUP  13 MASS  28 TO  28

MASS      X              Y              Z
  28   .187758E+04  0.              .310000E+03

                    ENGINE THRUST MATRICES GENERATED FOR   1 ENGS

                         7682 WORDS OF CORE REQ FOR STEP ***UNITLOAD  ***
```

BOX LOAD DATA

GEOMETRY FOR PANEL 1

ROW	X	Y	Z
1	.782987E+03	.172499E+03	.925636E+01
2	.828312E+03	.172499E+03	.925636E+01
3	.873637E+03	.172499E+03	.925636E+01
4	.919042E+03	.172499E+03	.925636E+01
5	.964213E+03	.172499E+03	.925636E+01
6	.100472E+04	.172499E+03	.925636E+01
7	.105365E+04	.172499E+03	.925636E+01
8	.109988E+04	.172499E+03	.925636E+01
9	.858475E+03	.299999E+03	.317364E+02
10	.898856E+03	.299999E+03	.317364E+02
11	.938837E+03	.299999E+03	.317364E+02
12	.970018E+03	.299999E+03	.317364E+02
13	.101901E+04	.299999E+03	.317364E+02
14	.105883E+04	.299999E+03	.317364E+02
15	.109823E+04	.299999E+03	.317364E+02
16	.113917E+04	.299999E+03	.317364E+02

BOX LOAD DATA

GEOMETRY FOR PANEL 2

ROW	X	Y	Z
17	.929950E+03	.412500E+03	.515750E+02
18	.960431E+03	.412500E+03	.515750E+02
19	.995812E+03	.412500E+03	.515750E+02
20	.103119E+04	.412500E+03	.515750E+02
21	.106657E+04	.412500E+03	.515750E+02
22	.110195E+04	.412500E+03	.515750E+02
23	.113756E+04	.412500E+03	.515750E+02
24	.117384E+04	.412500E+03	.515750E+02
25	.991738E+03	.525000E+03	.714140E+02
26	.102277E+04	.525000E+03	.714140E+02
27	.105380E+04	.525000E+03	.714140E+02
28	.108483E+04	.525000E+03	.714140E+02
29	.111572E+04	.525000E+03	.714140E+02
30	.114616E+04	.525000E+03	.714140E+02
31	.117690E+04	.525000E+03	.714140E+02
32	.120852E+04	.525000E+03	.714140E+02
33	.108057E+04	.675000E+03	.978620E+02
34	.110551E+04	.675000E+03	.978620E+02
35	.113044E+04	.675000E+03	.978620E+02
36	.115537E+04	.675000E+03	.978620E+02
37	.118018E+04	.675000E+03	.978620E+02
38	.120464E+04	.675000E+03	.978620E+02
39	.122934E+04	.675000E+03	.978620E+02
40	.125474E+04	.675000E+03	.978620E+02
41	.116201E+04	.812500E+03	.122106E+03
42	.118135E+04	.812500E+03	.122106E+03
43	.120069E+04	.812500E+03	.122106E+03
44	.122001E+04	.812500E+03	.122106E+03
45	.123929E+04	.812500E+03	.122106E+03
46	.125825E+04	.812500E+03	.122106E+03
47	.127741E+04	.812500E+03	.122106E+03
48	.129712E+04	.812500E+03	.122106E+03
49	.122123E+04	.912500E+03	.139738E+03
50	.123650E+04	.912500E+03	.139738E+03
51	.125178E+04	.912500E+03	.139738E+03
52	.126705E+04	.912500E+03	.139738E+03
53	.128226E+04	.912500E+03	.139738E+03
54	.129724E+04	.912500E+03	.139738E+03
55	.131237E+04	.912500E+03	.139738E+03
56	.132794E+04	.912500E+03	.139738E+03

BOX LOAD DATA

GEOMETRY FOR PANEL 5

ROW	X	Y	Z
57	.169040E+04	.800007E+02	.120191E+03
58	.172602E+04	.800007E+02	.120191E+03
59	.176184E+04	.800007E+02	.120191E+03
60	.179726E+04	.800007E+02	.120191E+03
61	.172367E+04	.147503E+03	.132094E+03
62	.175772E+04	.147503E+03	.132094E+03
63	.178889E+04	.147503E+03	.132094E+03
64	.182050E+04	.147503E+03	.132194E+03
65	.175309E+04	.200003E+03	.141351E+03
66	.178158E+04	.200003E+03	.141351E+03
67	.181008E+04	.200003E+03	.141351E+03
68	.183857E+04	.200003E+03	.141351E+03
69	.179575E+04	.262500E+03	.152372E+03
70	.181052E+04	.262500E+03	.152372E+03
71	.183530E+04	.262500E+03	.152372E+03
72	.186008E+04	.262500E+03	.152372E+03
73	.182493E+04	.337500E+03	.165597E+03
74	.184425E+04	.337500E+03	.165597E+03
75	.185557E+04	.337500E+03	.165597E+03
76	.188589E+04	.337500E+03	.165597E+03
77	.183077E+04	.800007E+02	.120191E+03
78	.185704E+04	.800007E+02	.120191E+03
79	.185024E+04	.147503E+03	.132094E+03
80	.187437E+04	.147503E+03	.132094E+03
81	.186537E+04	.200003E+03	.141351E+03
82	.188712E+04	.200003E+03	.141351E+03
83	.188339E+04	.262500E+03	.152372E+03
84	.190231E+04	.262500E+03	.152372E+03
85	.189501E+04	.337500E+03	.165597E+03
86	.192053E+04	.337500E+03	.165597E+03

BOX LOAD DATA

GEOMETRY FOR PANEL 4

ROW	X	Y	Z
87	.159299E+04	0.	.165000E+03
88	.163494E+04	0.	.165000E+03
89	.167688E+04	0.	.165000E+03
90	.171883E+04	0.	.165000E+03
91	.167005E+04	0.	.260001E+03
92	.170358E+04	0.	.260001E+03
93	.173712E+04	0.	.260001E+03
94	.177065E+04	0.	.260001E+03
95	.175117E+04	0.	.360001E+03
96	.177594E+04	0.	.360001E+03
97	.180052E+04	0.	.360001E+03
98	.182513E+04	0.	.360001E+03
99	.183794E+04	0.	.430000E+03
100	.182643E+04	0.	.430000E+03
101	.184490E+04	0.	.430000E+03
102	.186337E+04	0.	.430000E+03
103	.176371E+04	0.	.165000E+03
104	.180239E+04	0.	.165000E+03
105	.180415E+04	0.	.260001E+03
106	.183744E+04	0.	.260001E+03
107	.184983E+04	0.	.360001E+03
108	.187434E+04	0.	.360001E+03
109	.188182E+04	0.	.430000E+03
110	.190017E+04	0.	.430000E+03

ROD LOAD DATA

GEOMETRY FOR PANEL 9

ROD	X	Y	Z
111	.826088E+03	.375000E+03	.224800E+02
112	.863219E+03	.375000E+03	.224800E+02
113	.900350E+03	.375000E+03	.224800E+02
114	.937482E+03	.375000E+03	.224800E+02
115	.974437E+03	.375000E+03	.224800E+02
116	.101068E+04	.375000E+03	.224800E+02

7004 WORDS OF CORE USED FOR STEP ***UNITLOAD ***

BODY LOAD DATA

GEOMETRY FOR BODY GROUP 1 BODIES 1 TO 8

BODY	X	Y	Z
1	.1250000E+02	0.	0.
2	.6250000E+02	0.	0.
3	.1500000E+03	0.	0.
4	.2500000E+03	0.	0.
5	.3875000E+03	0.	0.
6	.5625000E+03	0.	0.
7	.7250000E+03	0.	0.
8	.8750000E+03	0.	0.

BODY LOAD DATA

GEOMETRY FOR BODY GROUP 2 BODIES 9 TO 11

BODY	X	Y	Z
9	.103550E+04	0.	0.
10	.118500E+04	0.	0.
11	.131900E+04	0.	0.

BODY LOAD DATA

GEOMETRY FOR BODY GROUP 3 BODIES 12 TO 12

BODY	X	Y	Z
12	.140000E+04	0.	0.

BODY LOAD DATA

GEOMETRY FOR BODY GROUP 6 BODIES 13 TO 13

BODY	X	Y	Z
13	.147988E+04	0.	0.

BODY LOAD DATA

GEOMETRY FOR BODY GROUP 6 BODIES 14 TO 14

BODY	X	Y	Z
14	.103100E+04	0.	0.

BODY LOAD DATA

[illegible] FOR BODY GROUP [illegible] NUMBER 15 TO 19

BODY	X	Y	Z
15	.6[illegible]E+03	.3750000E+03	-.4800000E+02
16	.6700000E+03	.3750000E+03	-.4800000E+02
17	.7825000E+03	.3750000E+03	-.5500000E+02
18	.8075000E+03	.3750000E+03	-.5500000E+02
19	.8850000E+03	.3750000E+03	-.5500000E+02

9134 WORDS OF CORE USED FOR STEP ***UNITLOAD ***

TABLE 29

EXAMPLE PROBLEM OUTPUT LISTING

FREQUENCY RESPONSE AND UNIT GUST MODULES

```
                                                         DATE
                                                         TIME
            FIXED DATA DECK INPUT GO

            IDENT0          6

            THE FOLLOWING ANALYSIS CODES HAVE BEEN CALLED FOR IN THIS RUN

                           FRSP    GUST


*********************

TAPE19 REWOUND

*********************
HEADER DATA READ FROM TAPE19
     NR      NSYM      NASYM     NGUST       NB      MACH      REFA      REFB      REFC
     10         7          9        13        2   .85E+00   .41E+06   .95E+03   .30E+03
            INERTIAL DATA

            NO. TOTAL MASSES          =  28
            NO. SYMMETRIC MODES       =   7
            NO. ANTISYMMETRIC MODES   =   9
            NO. ENGINES               =   1
            UNIT LOAD PRNT FLAG       =   0

            RUN DATA DECK INPUT GO

            FLIGHT DATA FOR FREQUENCY RESPONSE AND UNIT GUST LOADS

            VKEAS        =  552.150 KEAS
            ALTITUDE     =   1000.000 FT.
            SIZE FACTOR  =   1.0000 INCHES/UNIT
            VTRUE        =  946.342 FPS
            DYNAMIC P    = 1033.536 PSF
            SIGMA        =   .97104E+00
            MACH         =     .8506
            PLOT W FLG   =    0
            PLOT GST FLG=     2

                1781 WORDS OF CORE RQD FOR STEP ***  MAIN    ***
```

```
                                                                                                   DATE
                                                                                                   TIME
HEADER DATA READ  FROM TAPE34
    IDENT    NINTLD    NSTRSS      NENGS       NSYM       NASYM        NK    NARGRP    NBBGRP    NBUFES    NAERBB
        6        10         0          1          7           9        10         5         6        40         8

                    8137 WORDS OF CORE RQD FOR STEP ***AERO STG  ***

               SOLUTION FREQUENCY REQUEST FOR 145 FREQUENCIES

ITM       LWR F       UPR F        DEL F
  1       .0500       .9500        .0500
  2      1.0000      3.0000        .2000
  3      3.1000      5.0000        .1000
  4      5.2000     24.0000        .2000
HEADER DATA WRITTEN ON TAPE35
    IDENT     NGUST     NFREQ       NSYM       NASYM        NKI       VEL     SIGMA
        6        13       145          7           9         10  .95E+03   .97E+00

                   20188 WORDS OF CORE RQD FOR STEP *** FREQRS   ***
```

DATE
TIME

GUST ORIENTATION NO, 1
GAMX = ,86603
GAMY = 0,00000
GAMZ = ,50000
FREQUENCY RESPONSE SOLUTIONS

VEL = 552,19 KEAS DYNP = 7,18 Q/V = ,75843E+02 ALTITUDE = 1000,00 FT,

	Q	GENERALIZED RESPONSE	
IVB= =	1	VOB= = 240,98412	FREQ = ,0500
IVB= =	2	VOB= = 120,49206	FREQ = ,1000
IVB= =	3	VOB= = 80,32904	FREQ = ,1500
IVB= =	4	VOB= = 60,24603	FREQ = ,2000
IVB= =	5	VOB= = 48,19682	FREQ = ,2500
IVB= =	6	VOB= = 40,16402	FREQ = ,3000
IVB= =	7	VOB= = 34,42530	FREQ = ,3500
IVB= =	8	VOB= = 30,12302	FREQ = ,4000
IVB= =	9	VOB= = 26,77611	FREQ = ,4500
IVB= =	10	VOB= = 24,09841	FREQ = ,5000
IVB= =	11	VOB= = 21,90765	FREQ = ,5500
IVB= =	12	VOB= = 20,[illegible]	FREQ = ,6000
IVB= =	13	VOB= = 18,53724	FREQ = ,6500
IVB= =	14	VOB= = 17,21319	FREQ = ,7000
IVB= =	15	VOB= = 16,06561	FREQ = ,7500
IVB= =	16	VOB= = 15,06151	FREQ = ,8000
IVB= =	17	VOB= = 14,17554	FREQ = ,8500
IVB= =	18	VOB= = 13,38801	FREQ = ,9000
IVB= =	19	VOB= = 12,68337	FREQ = ,9500
IVB= =	20	VOB= = 12,04921	FREQ = 1,0000
IVB= =	21	VOB= = 10,04101	FREQ = 1,2000
IVB= =	22	VOB= = 8,60658	FREQ = 1,4000
IVB= =	23	VOB= = 7,53075	FREQ = 1,6000
IVB= =	24	VOB= = 6,69400	FREQ = 1,8000
IVB= =	25	VOB= = 6,02460	FREQ = 2,0000
IVB= =	26	VOB= = 5,47691	FREQ = 2,2000
IVB= =	27	VOB= = 5,02050	FREQ = 2,4000
IVB= =	28	VOB= = 4,63431	FREQ = 2,6000
IVB= =	29	VOB= = 4,30329	FREQ = 2,8000
IVB= =	30	VOB= = 4,01640	FREQ = 3,0000
IVB= =	31	VOB= = 3,88684	FREQ = 3,1000
IVB= =	32	VOB= = 3,76518	FREQ = 3,2000
IVB= =	33	VOB= = 3,65127	FREQ = 3,3000
IVB= =	34	VOB= = 3,54388	FREQ = 3,4000
IVB= =	35	VOB= = 3,44263	FREQ = 3,5000
IVB= =	36	VOB= = 3,34700	FREQ = 3,6000
IVB= =	37	VOB= = 3,25654	FREQ = 3,7000
IVB= =	38	VOB= = 3,17084	FREQ = 3,8000
IVB= =	39	VOB= = 3,08954	FREQ = 3,9000
IVB= =	40	VOB= = 3,01230	FREQ = 4,0000
IVB= =	41	VOB= = 2,93883	FREQ = 4,1000
IVB= =	42	VOB= = 2,86886	FREQ = 4,2000
IVB= =	43	VOB= = 2,80214	FREQ = 4,3000
IVB= =	44	VOB= = 2,73846	FREQ = 4,4000
IVB= =	45	VOB= = 2,67760	FREQ = 4,5000

DATE
TIME

GUST ORIENTATION NO. 1
GAMX = .86603
GAMY = 0.00000
GAMZ = .50000
FREQUENCY RESPONSE SOLUTIONS

VEL = 552,15 KEAS DYNP = 7,18 W/V = ,75843E+02 ALTITUDE = 1000,00 FT.

Q GENERALIZED RESPONSE

IVB =	46	VOB =	2,61939	FREQ =	4,6000
IVB =	47	VOB =	2,56366	FREQ =	4,7000
IVB =	48	VOB =	2,51025	FREQ =	4,8000
IVB =	49	VOB =	2,45302	FREQ =	4,9000
IVB =	50	VOB =	2,40984	FREQ =	5,0000
IVB =	51	VOB =	2,31716	FREQ =	5,2000
IVB =	52	VOB =	2,23133	FREQ =	5,4000
IVB =	53	VOB =	2,15184	FREQ =	5,6000
IVB =	54	VOB =	2,07748	FREQ =	5,8000
IVB =	55	VOB =	2,00820	FREQ =	6,0000
IVB =	56	VOB =	1,94342	FREQ =	6,2000
IVB =	57	VOB =	1,88263	FREQ =	6,4000
IVB =	58	VOB =	1,82564	FREQ =	6,6000
IVB =	59	VOB =	1,77194	FREQ =	6,8000
IVB =	60	VOB =	1,72132	FREQ =	7,0000
IVB =	61	VOB =	1,67350	FREQ =	7,2000
IVB =	62	VOB =	1,62829	FREQ =	7,4000
IVB =	63	VOB =	1,58542	FREQ =	7,6000
IVB =	64	VOB =	1,54477	FREQ =	7,8000
IVB =	65	VOB =	1,50615	FREQ =	8,0000
IVB =	66	VOB =	1,46742	FREQ =	8,2000
IVB =	67	VOB =	1,43445	FREQ =	8,4000
IVB =	68	VOB =	1,40107	FREQ =	8,6000
IVB =	69	VOB =	1,36923	FREQ =	8,8000
IVB =	70	VOB =	1,33880	FREQ =	9,0000
IVB =	71	VOB =	1,30970	FREQ =	9,2000
IVB =	72	VOB =	1,28183	FREQ =	9,4000
IVB =	73	VOB =	1,25513	FREQ =	9,6000
IVB =	74	VOB =	1,22951	FREQ =	9,8000
IVB =	75	VOB =	1,20492	FREQ =	10,0000
IVB =	76	VOB =	1,18129	FREQ =	10,2000
IVB =	77	VOB =	1,15854	FREQ =	10,4000
IVB =	78	VOB =	1,13672	FREQ =	10,6000
IVB =	79	VOB =	1,11567	FREQ =	10,8000
IVB =	80	VOB =	1,09538	FREQ =	11,0000
IVB =	81	VOB =	1,07582	FREQ =	11,2000
IVB =	82	VOB =	1,05695	FREQ =	11,4000
IVB =	83	VOB =	1,03872	FREQ =	11,6000
IVB =	84	VOB =	1,02112	FREQ =	11,8000
IVB =	85	VOB =	1,00410	FREQ =	12,0000
IVB =	86	VOB =	,98764	FREQ =	12,2000
IVB =	87	VOB =	,97171	FREQ =	12,4000
IVB =	88	VOB =	,95629	FREQ =	12,6000
IVB =	89	VOB =	,94134	FREQ =	12,8000
IVB =	90	VOB =	,92686	FREQ =	13,0000
IVB =	91	VOB =	,91282	FREQ =	13,2000

DATE
TIME

GUST ORIENTATION NO. 1
GAMX = .86603
GAMY = 0.00000
GAMZ = .50000
FREQUENCY RESPONSE SOLUTIONS

VEL = 592.15 KEAS DYNP = 7.18 Q/V = .75845E+02 ALTITUDE = 1000.00 FT.

Q GENERALIZED RESPONSE

IVB =	92	VQB =	.89910	FREQ =	13.4000
IVB =	93	VQB =	.88597	FREQ =	13.6000
IVB =	94	VQB =	.87313	FREQ =	13.8000
IVB =	95	VQB =	.86066	FREQ =	14.0000
IVB =	96	VQB =	.84854	FREQ =	14.2000
IVB =	97	VQB =	.83675	FREQ =	14.4000
IVB =	98	VQB =	.82520	FREQ =	14.6000
IVB =	99	VQB =	.81414	FREQ =	14.8000
IVB =	100	VQB =	.80328	FREQ =	15.0000
IVB =	101	VQB =	.79271	FREQ =	15.2000
IVB =	102	VQB =	.78242	FREQ =	15.4000
IVB =	103	VQB =	.77239	FREQ =	15.6000
IVB =	104	VQB =	.76261	FREQ =	15.8000
IVB =	105	VQB =	.75308	FREQ =	16.0000
IVB =	106	VQB =	.74378	FREQ =	16.2000
IVB =	107	VQB =	.73471	FREQ =	16.4000
IVB =	108	VQB =	.72586	FREQ =	16.6000
IVB =	109	VQB =	.71721	FREQ =	16.8000
IVB =	110	VQB =	.70878	FREQ =	17.0000
IVB =	111	VQB =	.70054	FREQ =	17.2000
IVB =	112	VQB =	.69248	FREQ =	17.4000
IVB =	113	VQB =	.68461	FREQ =	17.6000
IVB =	114	VQB =	.67692	FREQ =	17.8000
IVB =	115	VQB =	.66940	FREQ =	18.0000
IVB =	116	VQB =	.66204	FREQ =	18.2000
IVB =	117	VQB =	.65485	FREQ =	18.4000
IVB =	118	VQB =	.64781	FREQ =	18.6000
IVB =	119	VQB =	.64092	FREQ =	18.8000
IVB =	120	VQB =	.63417	FREQ =	19.0000
IVB =	121	VQB =	.62756	FREQ =	19.2000
IVB =	122	VQB =	.62109	FREQ =	19.4000
IVB =	123	VQB =	.61476	FREQ =	19.6000
IVB =	124	VQB =	.60855	FREQ =	19.8000
IVB =	125	VQB =	.60246	FREQ =	20.0000
IVB =	126	VQB =	.59650	FREQ =	20.2000
IVB =	127	VQB =	.59065	FREQ =	20.4000
IVB =	128	VQB =	.58491	FREQ =	20.6000
IVB =	129	VQB =	.57929	FREQ =	20.8000
IVB =	130	VQB =	.57377	FREQ =	21.0000
IVB =	131	VQB =	.56836	FREQ =	21.2000
IVB =	132	VQB =	.56305	FREQ =	21.4000
IVB =	133	VQB =	.55785	FREQ =	21.6000
IVB =	134	VQB =	.55272	FREQ =	21.8000
IVB =	135	VQB =	.54769	FREQ =	22.0000
IVB =	136	VQB =	.54276	FREQ =	22.2000
IVB =	137	VQB =	.53791	FREQ =	22.4000

DATE
TIME

GUST ORIENTATION NO, 1
GAMX = ,86603
GAMY = 0,00000
GAMZ = ,50000
FREQUENCY RESPONSE SOLUTIONS

VEL = 592,15 KEAS DYNP = 7,18 Q/V = ,75843E-02 ALTITUDE = 1000,00 FT,

Q GENERALIZED RESPONSE

IVB= = 138	VQB= = ,53315	FREQ = 22,6000
IVB= = 139	VQB= = ,52847	FREQ = 22,8000
IVB= = 140	VQB= = ,52388	FREQ = 23,0000
IVB= = 141	VQB= = ,51936	FREQ = 23,2000
IVB= = 142	VQB= = ,51492	FREQ = 23,4000
IVB= = 143	VQB= = ,51056	FREQ = 23,6000
IVB= = 144	VQB= = ,50627	FREQ = 23,8000
IVB= = 145	VQB= = ,50205	FREQ = 24,0000

DATE
TIME

GUST ORIENTATION NO. 13
GAMX = 0.00000
GAMY = -.70711
GAMZ = -.70711
FREQUENCY RESPONSE SOLUTIONS

VEL = 552.15 KEAS   DYNP = 7.18   Q/V = .75843E-02   ALTITUDE = 1000.00 FT.

0 GENERALIZED RESPONSE

IVB=	=	1	VOB=	=	240.98412	FREQ =	.0500
IVB=	=	2	VOB=	=	120.49206	FREQ =	.1000
IVB=	=	3	VOB=	=	80.32404	FREQ =	.1500
IVB=	=	4	VOB=	=	60.24603	FREQ =	.2000
IVB=	=	5	VOB=	=	48.19682	FREQ =	.2500
IVB=	=	6	VOB=	=	40.16402	FREQ =	.3000
IVB=	=	7	VOB=	=	34.42630	FREQ =	.3500
IVB=	=	8	VOB=	=	30.12302	FREQ =	.4000
IVB=	=	9	VOB=	=	26.77601	FREQ =	.4500
IVB=	=	10	VOB=	=	24.[illegible]	FREQ =	.5000
IVB=	=	11	VOB=	=	21.90765	FREQ =	.5500
IVB=	=	12	VOB=	=	20.[illegible]	FREQ =	.6000
IVB=	=	13	VOB=	=	18.53724	FREQ =	.6500
IVB=	=	14	VOB=	=	17.21315	FREQ =	.7000
IVB=	=	15	VOB=	=	16.06561	FREQ =	.7500
IVB=	=	16	VOB=	=	15.06151	FREQ =	.8000
IVB=	=	17	VOB=	=	14.17559	FREQ =	.8500
IVB=	=	18	VOB=	=	13.38801	FREQ =	.9000
IVB=	=	19	VOB=	=	12.68357	FREQ =	.9500
IVB=	=	20	VOB=	=	12.04921	FREQ =	1.0000
IVB=	=	21	VOB=	=	[illegible]	FREQ =	1.2000
IVB=	=	22	VOB=	=	[illegible]	FREQ =	1.4000
IVB=	=	23	VOB=	=	7.53079	FREQ =	1.6000
IVB=	=	24	VOB=	=	6.69405	FREQ =	1.8000
IVB=	=	25	VOB=	=	6.02465	FREQ =	2.0000
IVB=	=	26	VOB=	=	5.47691	FREQ =	2.2000
IVB=	=	27	VOB=	=	5.02059	FREQ =	2.4000
IVB=	=	28	VOB=	=	4.63431	FREQ =	2.6000
IVB=	=	29	VOB=	=	4.30320	FREQ =	2.8000
IVB=	=	30	VOB=	=	4.01640	FREQ =	3.0000
IVB=	=	31	VOB=	=	3.88684	FREQ =	3.1000
IVB=	=	32	VOB=	=	3.76538	FREQ =	3.2000
IVB=	=	33	VOB=	=	3.65127	FREQ =	3.3000
IVB=	=	34	VOB=	=	3.54388	FREQ =	3.4000
IVB=	=	35	VOB=	=	3.44263	FREQ =	3.5000
IVB=	=	36	VOB=	=	3.34700	FREQ =	3.6000
IVB=	=	37	VOB=	=	3.25654	FREQ =	3.7000
IVB=	=	38	VOB=	=	3.17084	FREQ =	3.8000
IVB=	=	39	VOB=	=	3.08954	FREQ =	3.9000
IVB=	=	40	VOB=	=	3.01230	FREQ =	4.0000
IVB=	=	41	VOB=	=	2.93883	FREQ =	4.1000
IVB=	=	42	VOB=	=	2.86886	FREQ =	4.2000
IVB=	=	43	VOB=	=	2.80214	FREQ =	4.3000
IVB=	=	44	VOB=	=	2.73846	FREQ =	4.4000
IVB=	=	45	VOB=	=	2.67760	FREQ =	4.5000

DATE
TIME

GUST ORIENTATION NO, 13
GAMX = 0,00000
GAMY = -,70711
GAMZ = -,70711
FREQUENCY RESPONSE SOLUTIONS

VEL = 552,15 KEAS DYNP = 7,18 Q/V = ,75843E-02 ALTITUDE = 1000,00 FT,

	Q	GENERALIZED RESPONSE			
IVB= =	46	VOB= =	2,61939	FREQ =	4,6000
IVB= =	47	VOB= =	2,56366	FREQ =	4,7000
IVB= =	48	VOB= =	2,51025	FREQ =	4,8000
IVB= =	49	VOB= =	2,45902	FREQ =	4,9000
IVB= =	50	VOB= =	2,40984	FREQ =	5,0000
IVB= =	51	VOB= =	2,31716	FREQ =	5,2000
IVB= =	52	VOB= =	2,23133	FREQ =	5,4000
IVB= =	53	VOB= =	2,15164	FREQ =	5,6000
IVB= =	54	VOB= =	2,07745	FREQ =	5,8000
IVB= =	55	VOB= =	2,00829	FREQ =	6,0000
IVB= =	56	VOB= =	1,94342	FREQ =	6,2000
IVB= =	57	VOB= =	1,88269	FREQ =	6,4000
IVB= =	58	VOB= =	1,82564	FREQ =	6,6000
IVB= =	59	VOB= =	1,77190	FREQ =	6,8000
IVB= =	60	VOB= =	1,72132	FREQ =	7,0000
IVB= =	61	VOB= =	1,67350	FREQ =	7,2000
IVB= =	62	VOB= =	1,62827	FREQ =	7,4000
IVB= =	63	VOB= =	1,58542	FREQ =	7,6000
IVB= =	64	VOB= =	1,54477	FREQ =	7,8000
IVB= =	65	VOB= =	1,50615	FREQ =	8,0000
IVB= =	66	VOB= =	1,46942	FREQ =	8,2000
IVB= =	67	VOB= =	1,43443	FREQ =	8,4000
IVB= =	68	VOB= =	1,40197	FREQ =	8,6000
IVB= =	69	VOB= =	1,36923	FREQ =	8,8000
IVB= =	70	VOB= =	[illegible]	FREQ =	9,0000
IVB= =	71	VOB= =	[illegible]	FREQ =	9,2000
IVB= =	72	VOB= =	1,28193	FREQ =	9,4000
IVB= =	73	VOB= =	1,25513	FREQ =	9,6000
IVB= =	74	VOB= =	1,22951	FREQ =	9,8000
IVB= =	75	VOB= =	1,20492	FREQ =	10,0000
IVB= =	76	VOB= =	1,18129	FREQ =	10,2000
IVB= =	77	VOB= =	1,15858	FREQ =	10,4000
IVB= =	78	VOB= =	1,13672	FREQ =	10,6000
IVB= =	79	VOB= =	1,11567	FREQ =	10,8000
IVB= =	80	VOB= =	1,09534	FREQ =	11,0000
IVB= =	81	VOB= =	1,07582	FREQ =	11,2000
IVB= =	82	VOB= =	1,05695	FREQ =	11,4000
IVB= =	83	VOB= =	1,03872	FREQ =	11,6000
IVB= =	84	VOB= =	1,02112	FREQ =	11,8000
IVB= =	85	VOB= =	1,00410	FREQ =	12,0000
IVB= =	86	VOB= =	,98764	FREQ =	12,2000
IVB= =	87	VOB= =	,97171	FREQ =	12,4000
IVB= =	88	VOB= =	,95629	FREQ =	12,6000
IVB= =	89	VOB= =	,94134	FREQ =	12,8000
IVB= =	90	VOB= =	,92686	FREQ =	13,0000
IVB= =	91	VOB= =	,91282	FREQ =	13,2000

DATE
TIME

GUST ORIENTATION NO. 15
GAMX = 0.00000
GAMY = -.70711
GAMZ = -.70711
FREQUENCY RESPONSE SOLUTIONS

VEL = 552.19 KEAS   DYNP = 7.18   Q/V = .75843E-02   ALTITUDE = 1000.00 FT.

GENERALIZED RESPONSE

IVAR =	92	VDOR =	.89919	FREQ =	13.4000
IVAR =	93	VDOR =	.88337	FREQ =	13.6000
IVAR =	94	VDOR =	.87313	FREQ =	13.8000
IVAR =	95	VDOR =	.86[illegible]96	FREQ =	14.0000
IVAR =	96	VDOR =	.84456	FREQ =	14.2000
IVAR =	97	VDOR =	.83678	FREQ =	14.4000
IVAR =	98	VDOR =	.82520	FREQ =	14.6000
IVAR =	99	VDOR =	.81414	FREQ =	14.8000
IVAR =	100	VDOR =	.80324	FREQ =	15.0000
IVAR =	101	VDOR =	.79271	FREQ =	15.2000
IVAR =	102	VDOR =	.78242	FREQ =	15.4000
IVAR =	103	VDOR =	.77219	FREQ =	15.6000
IVAR =	104	VDOR =	.76241	FREQ =	15.8000
IVAR =	105	VDOR =	.75358	FREQ =	16.0000
IVAR =	106	VDOR =	.74378	FREQ =	16.2000
IVAR =	107	VDOR =	.73471	FREQ =	16.4000
IVAR =	108	VDOR =	.72596	FREQ =	16.6000
IVAR =	109	VDOR =	.71721	FREQ =	16.8000
IVAR =	110	VDOR =	.7[illegible]78	FREQ =	17.0000
IVAR =	111	VDOR =	.70054	FREQ =	17.2000
IVAR =	112	VDOR =	.69249	FREQ =	17.4000
IVAR =	113	VDOR =	.68461	FREQ =	17.6000
IVAR =	114	VDOR =	.67693	FREQ =	17.8000
IVAR =	115	VDOR =	.66940	FREQ =	18.0000
IVAR =	116	VDOR =	.66204	FREQ =	18.2000
IVAR =	117	VDOR =	.65485	FREQ =	18.4000
IVAR =	118	VDOR =	.64781	FREQ =	18.6000
IVAR =	119	VDOR =	.64092	FREQ =	18.8000
IVAR =	120	VDOR =	.63417	FREQ =	19.0000
IVAR =	121	VDOR =	.62756	FREQ =	19.2000
IVAR =	122	VDOR =	.62109	FREQ =	19.4000
IVAR =	123	VDOR =	.61476	FREQ =	19.6000
IVAR =	124	VDOR =	.60855	FREQ =	19.8000
IVAR =	125	VDOR =	.60246	FREQ =	20.0000
IVAR =	126	VDOR =	.59650	FREQ =	20.2000
IVAR =	127	VDOR =	.59069	FREQ =	20.4000
IVAR =	128	VDOR =	.58491	FREQ =	20.6000
IVAR =	129	VDOR =	.57929	FREQ =	20.8000
IVAR =	130	VDOR =	.57377	FREQ =	21.0000
IVAR =	131	VDOR =	.56836	FREQ =	21.2000
IVAR =	132	VDOR =	.56305	FREQ =	21.4000
IVAR =	133	VDOR =	.55784	FREQ =	21.6000
IVAR =	134	VDOR =	.55272	FREQ =	21.8000
IVAR =	135	VDOR =	.54769	FREQ =	22.0000
IVAR =	136	VDOR =	.54276	FREQ =	22.2000
IVAR =	137	VDOR =	.53791	FREQ =	22.4000

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                                                                    DATE
                                                                    TIME

                    GUST ORIENTATION NO.  13
                    GAMA =  0.00000
                    GAMY =  -.70711
                    GAMZ =  -.70711
                    FREQUENCY RESPONSE SOLUTIONS

VPL =  552.15 KEAS     DYNP =       7.18     Q/V =  .75843E-02          ALTITUDE =   1000.00 FT.

        Q   GENERALIZED RESPONSE
IVBM = 138     VOBM =        .53115      FREQ =     22.6000
IVBM = 139     VOBM =        .52447      FREQ =     22.8000
IVBM = 140     VOBM =        .52388      FREQ =     23.0000
IVBM = 141     VOBM =        .51936      FREQ =     23.2000
IVBM = 142     VOBM =        .51402      FREQ =     23.4000
IVBM = 143     VOBM =        .51056      FREQ =     23.6000
IVBM = 144     VOBM =        .50627      FREQ =     23.8000
IVBM = 145     VOBM =        .50209      FREQ =     24.0000

********************

TAPE35 REWOUND

********************
HEADER DATA READ  FROM TAPE35
    IDENT      NGUST      NFREQ       NSYM      NASYM        NKI        VEL      SIGMA
        6         13        145          7          9         10    .95E+03    .97E+00

********************

TAPE35 REWOUND

********************
HEADER DATA READ  FROM TAPE35
    IDENT      NGUST      NFREQ       NSYM      NASYM        NKI        VEL      SIGMA
        6         13        145          7          9         10    .95E+03    .97E+00
                          14314 WORDS OF CORE USED FOR STEP ***UNITGUST  ***
HEADER DATA WRITTEN ON TAPE36
    IDENT      NGUST      NFREQ     NINTLO        VEL      SIGMA
        6         13        145         10     946.34        .97

********************

TAPE35 REWOUND

********************
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DATE
TIME

SYM, UNIT GUST LOADS FOR ORIENTATION NO. 13

INT. LOADS - MODULUS

INT. LOAD NO.

FREQ HZ	1	2	3	4	5	6	7	8
.050	.9570743E+02	.4839286E+05	.2710909E+02	.6895908E+02	.3728082E+01	0.	.7338774E+02	.9084570E+02
.100	.3112419E+03	.1583427E+06	.7446700E+02	.2385541E+03	.8819865E+01	0.	.2229214E+03	.3121577E+03
.150	.6770512E+03	.3459044E+06	.1431748E+03	.5384604E+03	.9987771E+01	0.	.4646361E+03	.6992096E+03
.200	.1052193E+04	.5370501E+06	.2034580E+03	.8544373E+03	.1171552E+02	0.	.7029202E+03	.1102162E+04
.250	.1315123E+04	.6713171E+06	.2385055E+03	.1093445E+04	.3106672E+02	0.	.8654447E+03	.1384429E+04
.300	.1512376E+04	.7711514E+06	.2615573E+03	.1255419E+04	.5876047E+02	0.	.9467366E+03	.1605242E+04
.350	.1692394E+04	.8622374E+06	.2825603E+03	.1419287E+04	.8959203E+02	0.	.1009314E+04	.1800105E+04
.400	.1871847E+04	.9527315E+06	.3046212E+03	.1570745E+04	.1236030E+03	0.	.1213975E+04	.1991544E+04
.450	.2053540E+04	.1043990E+07	.3283202E+03	.1736002E+04	.1604549E+03	0.	.1332452E+04	.2162287E+04
.500	.2235760E+04	.1133041E+07	.3535411E+03	.1894515E+04	.1997251E+03	0.	.1453734E+04	.2370371E+04
.550	.2415742E+04	.1224699E+07	.3800273E+03	.2047819E+04	.2429104E+03	0.	.1576164E+04	.2552436E+04
.600	.2571051E+04	.1311258E+07	.4075480E+03	.2199582E+04	.2834815E+03	0.	.1694264E+04	.2725752E+04
.650	.2759425E+04	.1393970E+07	.4359492E+03	.2342019E+04	.3269362E+03	0.	.1818304E+04	.2886036E+04
.700	.2920341E+04	.1472211E+07	.4651649E+03	.2476022E+04	.3708193E+03	0.	.1937406E+04	.3037842E+04
.750	.3072770E+04	.1545750E+07	.4952124E+03	.2601144E+04	.4148461E+03	0.	.2055366E+04	.3174362E+04
.800	.3217151E+04	.1614702E+07	.5261809E+03	.2717506E+04	.4587106E+03	0.	.2147649E+04	.3249287E+04
.850	.3354170E+04	.1679432E+07	.5582166E+03	.2825060E+04	.5022802E+03	0.	.2240115E+04	.3411651E+04
.900	.3484497E+04	.1740049E+07	.5915038E+03	.2926453E+04	.5454841E+03	0.	.2391719E+04	.3513652E+04
.950	.3610570E+04	.1794402E+07	.6262770E+03	.3020907E+04	.5883171E+03	0.	.2503364E+04	.3604796E+04
1.000	.3732542E+04	.1854621E+07	.6627640E+03	.3110118E+04	.6308222E+03	0.	.2615944E+04	.3684175E+04
1.200	.4202365E+04	.2061244E+07	.8302159E+03	.3429328E+04	.8010165E+03	0.	.3049960E+04	.3954418E+04
1.400	.4724261E+04	.2283479E+07	.1048186E+04	.3751446E+04	.9697913E+03	0.	.3665940E+04	.4191736E+04
1.600	.5335267E+04	.2533054E+07	.1335331E+04	.4096580E+04	.1155140E+04	0.	.4382542E+04	.4376656E+04
1.800	.6028067E+04	.2809780E+07	.1714747E+04	.4430490E+04	.1364210E+04	0.	.5267689E+04	.4512960E+04
2.000	.6636324E+04	.3024448E+07	.2161497E+04	.4610536E+04	.1558024E+04	0.	.6176582E+04	.4425163E+04
2.200	.6832222E+04	.2941456E+07	.2503285E+04	.4269492E+04	.1728944E+04	0.	.6561021E+04	.3804907E+04
2.400	.5680492E+04	.2453129E+07	.2525344E+04	.3281101E+04	.1750889E+04	0.	.6306065E+04	.2649473E+04
2.600	.4349109E+04	.1774680E+07	.2322678E+04	.2130387E+04	.1730684E+04	0.	.4461686E+04	.1483224E+04
2.800	.3211119E+04	.1222029E+07	.2111121E+04	.1202091E+04	.1757494E+04	0.	.3604815E+04	.6378352E+03
3.000	.2377506E+04	.8115901E+06	.1972316E+04	.5504425E+03	.1837278E+04	0.	.2938171E+04	.2656428E+03
3.100	.2084526E+04	.6393499E+06	.1946530E+04	.3597064E+03	.1887767E+04	0.	.2605786E+04	.3948018E+03
3.200	.1831531E+04	.5278512E+06	.1935165E+04	.3185074E+03	.1942247E+04	0.	.2360054E+04	.5459421E+03
3.300	.1625040E+04	.4199623E+06	.1943955E+04	.4198189E+03	.1997178E+04	0.	.2047556E+04	.6950648E+03
3.400	.1459030E+04	.3371994E+06	.1971967E+04	.5673530E+03	.2048983E+04	0.	.1828110E+04	.8374841E+03
3.500	.1329731E+04	.2549661E+06	.2018533E+04	.7182743E+03	.2093487E+04	0.	.1648331E+04	.9639580E+03
3.600	.1235831E+04	.2675114E+06	.2083340E+04	.8607853E+03	.2125887E+04	0.	.1511329E+04	.1078649E+04
3.700	.1178710E+04	.2944652E+06	.2166584E+04	.9909543E+03	.2140882E+04	0.	.1421454E+04	.1162700E+04
3.800	.1162433E+04	.3342281E+06	.2269255E+04	.1105899E+04	.2133059E+04	0.	.1381818E+04	.1277119E+04
3.900	.1192940E+04	.3927100E+06	.2393624E+04	.1207563E+04	.2097482E+04	0.	.1391584E+04	.1363126E+04
4.000	.1276790E+04	.4550749E+06	.2543745E+04	.1292660E+04	.2030186E+04	0.	.1445113E+04	.1442732E+04
4.100	.1419951E+04	.5272446E+06	.2727239E+04	.1363862E+04	.1929724E+04	0.	.1533972E+04	.1519394E+04
4.200	.1628124E+04	.5996427E+06	.2954125E+04	.1423150E+04	.1795444E+04	0.	.1650275E+04	.1596612E+04
4.300	.1908116E+04	.6764409E+06	.3239120E+04	.1474539E+04	.1620804E+04	0.	.1789101E+04	.1688223E+04
4.400	.2268415E+04	.7596927E+06	.3599188E+04	.1521923E+04	.1419283E+04	0.	.1908613E+04	.1797907E+04
4.500	.2714951E+04	.8504128E+06	.4046446E+04	.1560327E+04	.1242831E+04	0.	.2126410E+04	.1936376E+04
4.600	.3232767E+04	.9435737E+06	.4564520E+04	.1599256E+04	.1095439E+04	0.	.2308549E+04	.2102075E+04

DATE
TIME

INT. LOADS - MODULUS

INT. LOAD NO.

FREQ HZ	1	2	3	4	5	6	7	8
4.700	.3741227E+04	.1010104E+07	.8055218E+04	.1592145E+04	.1103500E+04	0.	.2447977E+04	.2261896E+04
4.800	.4053424E+04	.1032418E+07	.9297221E+04	.1498345E+04	.1100071E+04	0.	.2455119E+04	.2331937E+04
4.900	.3987452E+04	.9561193E+06	.5092344E+04	.1302804E+04	.1526714E+04	0.	.2270687E+04	.2245522E+04
5.000	.3592799E+04	.8178134E+06	.4528006E+04	.1065827E+04	.1638894E+04	0.	.1962974E+04	.2023975E+04
5.200	.2534447E+04	.5449579E+06	.3270209E+04	.7136827E+03	.1562171E+04	0.	.1400429E+04	.1556303E+04
5.400	.1818252E+04	.3730373E+06	.2404587E+04	.5623876E+03	.1364721E+04	0.	.1074594E+04	.1246626E+04
5.600	.1348627E+04	.2726348E+06	.1865320E+04	.5148266E+03	.1174248E+04	0.	.8246039E+03	.1055696E+04
5.800	.1030919E+04	.2120819E+06	.1510327E+04	.5094686E+03	.1010392E+04	0.	.7634546E+03	.9287251E+03
6.000	.7422634E+03	.1737492E+06	.1267686E+04	.5272427E+03	.8676475E+03	0.	.6495485E+03	.8352441E+03
6.200	.5432407E+03	.1474923E+06	.1089765E+04	.5437705E+03	.7539141E+03	0.	.6429175E+03	.7636128E+03
6.400	.3943788E+03	.1296454E+06	.9571959E+03	.5683029E+03	.6470391E+03	0.	.5912786E+03	.7036208E+03
6.600	.2711758E+03	.1166980E+06	.8559593E+03	.5942284E+03	.5570503E+03	0.	.5459559E+03	.6523712E+03
6.800	.1798173E+03	.1075218E+06	.7761526E+03	.6203577E+03	.4787117E+03	0.	.5052365E+03	.6073039E+03
7.000	.1147459E+03	.1004337E+06	.7132066E+03	.6460207E+03	.4101672E+03	0.	.4686[illegible]E+03	.5667748E+03
7.200	.1071340E+03	.9493059E+05	.6627629E+03	.6704352E+03	.3499176E+03	0.	.4345434E+03	.5297003E+03
7.400	.1424484E+03	.9354322E+05	.6220179E+03	.6945753E+03	.2967534E+03	0.	.4133272E+03	.4953527E+03
7.600	.1897758E+03	.8695085E+05	.5889249E+03	.7171237E+03	.2496990E+03	0.	.3744553E+03	.4632396E+03
7.800	.2372126E+03	.8593018E+05	.5619474E+03	.7384110E+03	.2079685E+03	0.	.3491081E+03	.4353318E+03
8.000	.2818793E+03	.8132311E+05	.5398989E+03	.7584003E+03	.1709318E+03	0.	.3256645E+03	.4035148E+03
8.200	.3232402E+03	.7901725E+05	.5216350E+03	.7770692E+03	.1391062E+03	0.	.3044266E+03	.3775686E+03
8.400	.3614049E+03	.7693008E+05	.5069795E+03	.7943973E+03	.1031322E+03	0.	.2866645E+03	.3522046E+03
8.600	.3966723E+03	.7500161E+05	.4946565E+03	.8103561E+03	.8341693E+02	0.	.2664174E+03	.3284145E+03
8.800	.4294024E+03	.7318845E+05	.4842292E+03	.8248927E+03	.6220191E+02	0.	.2551622E+03	.3063510E+03
9.000	.4634124E+03	.7188880E+05	.4755202E+03	.8406704E+03	.4320222E+02	0.	.2421497E+03	.2835402E+03
9.200	.4891095E+03	.6974512E+05	.4656147E+03	.8490275E+03	.3257884E+02	0.	.2333353E+03	.2686079E+03
9.400	.5166237E+03	.6808679E+05	.4567473E+03	.8585111E+03	.2785557E+02	0.	.2251648E+03	.2538616E+03
9.600	.5424510E+03	.6647970E+05	.4489610E+03	.8669176E+03	.3099232E+02	0.	.2169422E+03	.2423917E+03
9.800	.5660336E+03	.6492403E+05	.4425585E+03	.8740804E+03	.3841628E+02	0.	.2137304E+03	.2344798E+03
10.000	.5891020E+03	.6341887E+05	.4376475E+03	.8801880E+03	.4706378E+02	0.	.2004912E+03	.2312659E+03
10.200	.6099775E+03	.6190318E+05	.4346356E+03	.8853037E+03	.5563147E+02	0.	.2059768E+03	.2297069E+03
10.400	.6292736E+03	.6055591E+05	.4335473E+03	.8894739E+03	.6364648E+02	0.	.2029489E+03	.2325685E+03
10.600	.6470295E+03	.5919629E+05	.4346338E+03	.8927320E+03	.7092779E+02	0.	.2001784E+03	.2344565E+03
10.800	.6633067E+03	.5780364E+05	.4381106E+03	.8951014E+03	.7741780E+02	0.	.1974452E+03	.2468758E+03
11.000	.6781665E+03	.5661743E+05	.4442175E+03	.8965954E+03	.8310238E+02	0.	.1945357E+03	.2572931E+03
11.200	.6917866E+03	.5539728E+05	.4532330E+03	.8972209E+03	.8798406E+02	0.	.1912392E+03	.2691651E+03
11.400	.7042761E+03	.5422292E+05	.4654977E+03	.8969719E+03	.9206818E+02	0.	.1873404E+03	.2820653E+03
11.600	.7159482E+03	.5309420E+05	.4814577E+03	.8958129E+03	.9535510E+02	0.	.1826066E+03	.2954907E+03
11.800	.7270734E+03	.5201107E+05	.5017576E+03	.8937696E+03	.9782806E+02	0.	.1767605E+03	.3090488E+03
12.000	.7407194E+03	.5119760E+05	.5354435E+03	.8902382E+03	.9935091E+02	0.	.1682460E+03	.3240052E+03
12.200	.7514269E+03	.4994083E+05	.5615926E+03	.8864412E+03	.9994640E+02	0.	.1596425E+03	.3346273E+03
12.400	.7666579E+03	.4903788E+05	.6022927E+03	.8811307E+03	.9963502E+02	0.	.1479232E+03	.3462329E+03
12.600	.7842970E+03	.4814774E+05	.6474845E+03	.8749595E+03	.9877663E+02	0.	.1348385E+03	.3573789E+03
12.800	.8045734E+03	.4731145E+05	.6961209E+03	.8680123E+03	.9753443E+02	0.	.1205586E+03	.3680976E+03
13.000	.8276314E+03	.4652899E+05	.7474573E+03	.8603453E+03	.9603924E+02	0.	.1053626E+03	.3783613E+03
13.200	.8535202E+03	.4579974E+05	.8009095E+03	.8520000E+03	.9440678E+02	0.	.8918586E+02	.3881131E+03
13.400	.8822016E+03	.4512267E+05	.8559963E+03	.8430094E+03	.9274516E+02	0.	.7280867E+02	.3972783E+03
13.600	.9135630E+03	.4449643E+05	.9123101E+03	.8334007E+03	.9119802E+02	0.	.5589568E+02	.4057696E+03

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INT. LOADS - MODULUS

INT. LOAD NO.

FREQ HZ	1	2	3	4	5	6	7	8
13.800	.9474311E+03	.4391944E+05	.9674494E+03	.8231981E+03	.8979117E+02	0.	.3922780E+02	.4113880E+03
14.000	.9835974E+03	.4339017E+05	.1027255E+04	.8124236E+03	.8862471E+02	0.	.2440605E+02	.4203225E+03
14.200	.1021813E+04	.4290880E+05	.1045520E+04	.8015948E+03	.8758233E+02	0.	.2042778E+02	.4261474E+03
14.400	.1061817E+04	.4246777E+05	.1143453E+04	.7892459E+03	.8762691E+02	0.	.3165534E+02	.4309160E+03
14.600	.1103334E+04	.4207147E+05	.1201465E+04	.7768881E+03	.8798261E+02	0.	.4922107E+02	.4341498E+03
14.800	.1146068E+04	.4171757E+05	.1259200E+04	.7640493E+03	.8900075E+02	0.	.6878104E+02	.4359135E+03
15.000	.1202358E+04	.4163974E+05	.1333992E+04	.7460509E+03	.9151880E+02	0.	.9509357E+02	.4345767E+03
15.200	.1204647E+04	.4061173E+05	.1334313E+04	.7463586E+03	.9202716E+02	0.	.9746757E+02	.4364799E+03
15.400	.1278054E+04	.4091748E+05	.1430338E+04	.7228766E+03	.9794954E+02	0.	.1327959E+03	.4272897E+03
15.600	.1325502E+04	.4072513E+05	.1447573E+04	.7087588E+03	.1026744E+03	0.	.1555255E+03	.4199339E+03
15.800	.1376000E+04	.4055958E+05	.1545299E+04	.6947858E+03	.1079933E+03	0.	.1781755E+03	.4109492E+03
16.000	.1429692E+04	.4041713E+05	.1613564E+04	.6811312E+03	.1137174E+03	0.	.2012197E+03	.4005086E+03
16.200	.1480512E+04	.4029454E+05	.1662349E+04	.6679678E+03	.1177564E+03	0.	.2234346E+03	.3847431E+03
16.400	.1546337E+04	.4018882E+05	.1721588E+04	.6554696E+03	.1260135E+03	0.	.2474193E+03	.3757584E+03
16.600	.1608825E+04	.4009744E+05	.1761168E+04	.6439161E+03	.1324031E+03	0.	.2704011E+03	.3616430E+03
16.800	.1673641E+04	.4001827E+05	.1840944E+04	.6331901E+03	.1388476E+03	0.	.2951263E+03	.3464727E+03
17.000	.1740372E+04	.3994347E+05	.1900747E+04	.6237791E+03	.1452758E+03	0.	.3155062E+03	.3303098E+03
17.200	.1808598E+04	.3987534E+05	.1960377E+04	.6157750E+03	.1516204E+03	0.	.3374298E+03	.3132102E+03
17.400	.1877691E+04	.3980823E+05	.2019605E+04	.6093741E+03	.1578162E+03	0.	.3587773E+03	.2952158E+03
17.600	.1947196E+04	.3973778E+05	.2078170E+04	.6047804E+03	.1637969E+03	0.	.3794146E+03	.2763541E+03
17.800	.2016410E+04	.3965843E+05	.2135761E+04	.6022167E+03	.1694902E+03	0.	.3991813E+03	.2562681E+03
18.000	.2108196E+04	.3974380E+05	.2211656E+04	.6023080E+03	.1766372E+03	0.	.4239021E+03	.2277757E+03
18.200	.2109973E+04	.3913863E+05	.2212649E+04	.6029975E+03	.1766494E+03	0.	.4252066E+03	.2286108E+03
18.400	.2211663E+04	.3926259E+05	.2297878E+04	.6099588E+03	.1838178E+03	0.	.4568224E+03	.1912629E+03
18.600	.2273009E+04	.3908301E+05	.2349289E+04	.6174013E+03	.1876356E+03	0.	.4651146E+03	.1677923E+03
18.800	.2333777E+04	.3889513E+05	.2400304E+04	.6266595E+03	.1910504E+03	0.	.4785404E+03	.1441000E+03
19.000	.2394133E+04	.3870253E+05	.2450962E+04	.6374975E+03	.1941015E+03	0.	.4909357E+03	.1207008E+03
19.200	.2454076E+04	.3850752E+05	.2501173E+04	.6497043E+03	.1967628E+03	0.	.5023055E+03	.9846678E+02
19.400	.2513486E+04	.3831163E+05	.2550702E+04	.6630633E+03	.1990357E+03	0.	.5126329E+03	.7907664E+02
19.600	.2572140E+04	.3811595E+05	.2599208E+04	.6774475E+03	.2009047E+03	0.	.5218834E+03	.6577756E+02
19.800	.2629752E+04	.3792127E+05	.2646244E+04	.6926179E+03	.2023467E+03	0.	.5300049E+03	.6309299E+02
20.000	.2685907E+04	.3772828E+05	.2691248E+04	.7084212E+03	.2033303E+03	0.	.5369274E+03	.7250838E+02
20.200	.2740113E+04	.3753766E+05	.2733527E+04	.7246876E+03	.2038140E+03	0.	.5425591E+03	.9042059E+02
20.400	.2791747E+04	.3735029E+05	.2772220E+04	.7412467E+03	.2037436E+03	0.	.5467796E+03	.1128262E+03
20.600	.2840057E+04	.3716732E+05	.2806226E+04	.7579185E+03	.2030464E+03	0.	.5494262E+03	.1374204E+03
20.800	.2883794E+04	.3699048E+05	.2834040E+04	.7744932E+03	.2018191E+03	0.	.5502627E+03	.1630047E+03
21.000	.2934407E+04	.3690366E+05	.2857563E+04	.7969659E+03	.1980072E+03	0.	.5470815E+03	.2001048E+03
21.200	.2935185E+04	.3655760E+05	.2857627E+04	.7977695E+03	.1978068E+03	0.	.5477068E+03	.1996617E+03
21.400	.2965706E+04	.3653376E+05	.2849242E+04	.8194772E+03	.1907247E+03	0.	.5365565E+03	.2392314E+03
21.600	.2970718E+04	.3643460E+05	.2832120E+04	.8351755E+03	.1849921E+03	0.	.5273581E+03	.2636576E+03
21.800	.2983108E+04	.3637671E+05	.2808975E+04	.8518021E+03	.1786208E+03	0.	.5172527E+03	.2876449E+03
22.000	.2985955E+04	.3636623E+05	.2781389E+04	.8702302E+03	.1717430E+03	0.	.5067546E+03	.3112011E+03
22.200	.2986100E+04	.3640807E+05	.2750627E+04	.8900831E+03	.1644664E+03	0.	.4963076E+03	.3343257E+03
22.400	.2984289E+04	.3650588E+05	.2717784E+04	.9132709E+03	.1568859E+03	0.	.4863130E+03	.3570120E+03
22.600	.2981130E+04	.3666208E+05	.2683633E+04	.9380113E+03	.1490802E+03	0.	.4771381E+03	.3792476E+03
22.800	.2977244E+04	.3687782E+05	.2649081E+04	.9644449E+03	.1411612E+03	0.	.4601152E+03	.4010147E+03
23.000	.2973165E+04	.3715297E+05	.2616182E+04	.9936466E+03	.1331866E+03	0.	.4625350E+03	.4222804E+03

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INT. LOADS - MODULUS

INT. LOAD NO.

FREQ HZ	1	2	3	4	5	6	7	8
23.200	.2969441E+04	.3748404E+05	.2584155E+04	.1024235E+04	.1252526E+03	0.	.4576556E+03	.4430410E+03
23.400	.2956816E+04	.3787419E+05	.2554403E+04	.1056377E+04	.1174518E+03	0.	.4545899E+03	.4632297E+03
23.600	.2955261E+04	.3831388E+05	.2527736E+04	.1089791E+04	.1098857E+03	0.	.4534924E+03	.4824031E+03
23.800	.2960032E+04	.3879663E+05	.2505029E+04	.1124138E+04	.1026717E+03	0.	.4543465E+03	.5010878E+03
24.000	.2973199E+04	.3960764E+05	.2481491E+04	.1175876E+04	.9307195E+02	0.	.4588497E+03	.5284600E+03

INT. LOADS - MODULUS

INT. LOAD NO.

FREQ HZ	9	10
.050	.1689[illegible]E+01	0.
.100	.8069250E+01	0.
.150	.2104153E+02	0.
.200	.3579340E+02	0.
.250	.477[illegible]E+02	0.
.300	.5558547E+02	0.
.350	.6311322E+02	0.
.400	.7050375E+02	0.
.450	.77238[illegible]E+02	0.
.500	.8189[illegible]E+02	0.
.550	.9010254E+02	0.
.600	.9596241E+02	0.
.650	.1012180E+03	0.
.700	.10554[illegible]E+03	0.
.750	.109963[illegible]E+03	0.
.800	.1134524E+03	0.
.850	.1163472E+03	0.
.900	.1188487E+03	0.
.950	.1207656E+03	0.
1.000	.1223079E+03	0.
1.200	.1251855E+03	0.
1.400	.1247034E+03	0.
1.600	.1219269E+03	0.
1.800	.1170144E+03	0.
2.000	.1095671E+03	0.
2.200	.1078125E+03	0.
2.400	.9540451E+02	0.
2.600	.9428880E+02	0.
2.800	.9414259E+02	0.
3.000	.9393617E+02	0.
3.100	.9369912E+02	0.
3.200	.9318506E+02	0.
3.300	.9250790E+02	0.
3.400	.9164605E+02	0.
3.500	.9050459E+02	0.
3.600	.8921643E+02	0.

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INT, LOADS = MODULUS

INT, LOAD NO,

FREQ HZ	9	10
3,700	,6754574E+02	0,
3,800	,9549337E+02	0,
3,900	,8302525E+02	0,
4,000	,8072 42E+02	0,
4,100	,7649174E+02	0,
4,200	,7233252E+02	0,
4,300	,6747586E+02	0,
4,400	,6148635E+02	0,
4,500	,5433564E+02	0,
4,600	,4623255E+02	0,
4,700	,3992454E+02	0,
4,800	,4201432E+02	0,
4,900	,5264564E+02	0,
5,000	,6346599E+02	0,
5,200	,7455731E+02	0,
5,400	,7783937E+02	0,
5,600	,7888944E+02	0,
5,800	,7953867 E+02	0,
6,000	,8045899E+02	0,
6,200	,8099355E+02	0,
6,400	,8193257E+02	0,
6,600	,8314874E+02	0,
6,800	,8432595E+02	0,
7,000	,8575495E+02	0,
7,200	,8733937E+02	0,
7,400	,8925857E+02	0,
7,600	,9093595E+02	0,
7,800	,9288401E+02	0,
8,000	,9498347E+02	0,
8,200	,9722359E+02	0,
8,400	,9953 21E+02	0,
8,600	,1023977E+03	0,
8,800	,1047681E+03	0,
9,000	,1081913E+03	0,
9,200	,1116945E+03	0,
9,400	,1143224E+03	0,
9,600	,1175829E+03	0,
9,800	,1212914E+03	0,
10,000	,1251491E+03	0,
10,200	,1292373E+03	0,
10,400	,1334098E+03	0,
10,600	,1370834E+03	0,
10,800	,1420530E+03	0,
11,000	,1464327E+03	0,
11,200	,1509596E+03	0,
11,400	,1552740E+03	0,
11,600	,1590585E+03	0,

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INT, LOADS = MODULUS

INT, LOAD NO,

FREQ HZ	9	10
11.800	.1619743E+03	0.
12.000	.1692199E+03	0.
12.200	.1722316E+03	0.
12.400	.1761047E+03	0.
12.600	.1798235E+03	0.
12.800	.1835843E+03	0.
13.000	.1867968E+03	0.
13.200	.1900447E+03	0.
13.400	.1931254E+03	0.
13.600	.1960307E+03	0.
13.800	.1987553E+03	0.
14.000	.2012715E+03	0.
14.200	.2035745E+03	0.
14.400	.2056510E+03	0.
14.600	.2074657E+03	0.
14.800	.2089844E+03	0.
15.000	.2104239E+03	0.
15.200	.2104038E+03	0.
15.400	.2110515E+03	0.
15.600	.2109685E+03	0.
15.800	.2106188E+03	0.
16.000	.2100374E+03	0.
16.200	.2092534E+03	0.
16.400	.2082843E+03	0.
16.600	.2071684E+03	0.
16.800	.2058964E+03	0.
17.000	.2045031E+03	0.
17.200	.2030033E+03	0.
17.400	.2014084E+03	0.
17.600	.1997349E+03	0.
17.800	.1980049E+03	0.
18.000	.1955862E+03	0.
18.200	.1955894E+03	0.
18.400	.1926649E+03	0.
18.600	.1908803E+03	0.
18.800	.1890701E+03	0.
19.000	.1872983E+03	0.
19.200	.1855062E+03	0.
19.400	.1837157E+03	0.
19.600	.1819195E+03	0.
19.800	.1801207E+03	0.
20.000	.1783123E+03	0.
20.200	.1764870E+03	0.
20.400	.1746349E+03	0.
20.600	.1727424E+03	0.
20.800	.1707908E+03	0.
21.000	.1678095E+03	0.

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INT, LOADS = MODULUS

INT, LOAD NO,

FREQ HZ	9	10
21.200	.1679632E+03	0.
21.400	.1642657E+03	0.
21.600	.1617682E+03	0.
21.800	.1592470E+03	0.
22.000	.1566344E+03	0.
22.200	.1540911E+03	0.
22.400	.1514851E+03	0.
22.600	.1488824E+03	0.
22.800	.1463011E+03	0.
23.000	.1437565E+03	0.
23.200	.1412660E+03	0.
23.400	.1388477E+03	0.
23.600	.1365218E+03	0.
23.800	.1343125E+03	0.
24.000	.1312946E+03	0.

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ASYM, UNIT GUST LOADS FOR ORIENTATION NO, 13

INT, LOADS - MODULUS

INT, LOAD NO,

FREQ HZ	1	2	3	4	5	6	7	8
.050	.7443511E+01	.4216080E+04	0.	0.	.8338594E+01	.2595407E+02	.6377666E+01	.6511450E+01
.100	.4130173E+02	.2349175E+05	0.	0.	.3446578E+02	.1431550E+03	.3752487E+02	.3603429E+02
.150	.8874377E+02	.4487128E+05	0.	0.	.7077814E+02	.2975486E+03	.7990108E+02	.7350864E+02
.200	.1171711E+03	.8149751E+05	0.	0.	.8977240E+02	.3761884E+03	.1102865E+03	.9139482E+02
.250	.1321535E+03	.6335465E+05	0.	0.	.9710585E+02	.4018602E+03	.1164213E+03	.9642884E+02
.300	.1426862E+03	.6593157E+05	0.	0.	.1006594E+03	.4130849E+03	.1247031E+03	.9647551E+02
.350	.1522228E+03	.6511787E+05	0.	0.	.1031073E+03	.4157078E+03	.1319105E+03	.9601387E+02
.400	.1616821E+03	.6354323E+05	0.	0.	.1052901E+03	.4151656E+03	.1386807E+03	.9476243E+02
.450	.1701808E+03	.6149178E+05	0.	0.	.1075072E+03	.4128326E+03	.1456091E+03	.9397700E+02
.500	.1792138E+03	.5940991E+05	0.	0.	.1098780E+03	.4093198E+03	.1527452E+03	.9427521E+02
.550	.1884511E+03	.5626357E+05	0.	0.	.1124534E+03	.4049376E+03	.1597854E+03	.9518084E+02
.600	.1977282E+03	.5328597E+05	0.	0.	.1152554E+03	.3998615E+03	.1667763E+03	.1000820E+03
.650	.2070317E+03	.5013030E+05	0.	0.	.1182931E+03	.3941940E+03	.1737294E+03	.1061837E+03
.700	.2163312E+03	.4684728E+05	0.	0.	.1215693E+03	.3880175E+03	.1806870E+03	.1145008E+03
.750	.2256109E+03	.4348978E+05	0.	0.	.1250863E+03	.3813671E+03	.1875852E+03	.1244977E+03
.800	.2348432E+03	.4011667E+05	0.	0.	.1288312E+03	.3742797E+03	.1940367E+03	.1371531E+03
.850	.2440174E+03	.3679726E+05	0.	0.	.1328691E+03	.3667748E+03	.2005517E+03	.1511134E+03
.900	.2531276E+03	.3361466E+05	0.	0.	.1370103E+03	.3588604E+03	.2069169E+03	.1662298E+03
.950	.2621691E+03	.3066200E+05	0.	0.	.1414264E+03	.3505986E+03	.2131256E+03	.1825750E+03
1.000	.2711441E+03	.2812752E+05	0.	0.	.1460472E+03	.3419349E+03	.2191745E+03	.1998480E+03
1.200	.3067735E+03	.2482293E+05	0.	0.	.1662676E+03	.3032922E+03	.2420080E+03	.2750715E+03
1.400	.3416765E+03	.3346812E+05	0.	0.	.1878528E+03	.2593243E+03	.2624249E+03	.3553678E+03
1.600	.3768555E+03	.4702549E+05	0.	0.	.2134363E+03	.2084535E+03	.2807207E+03	.4312517E+03
1.800	.4125515E+03	.6142824E+05	0.	0.	.2458867E+03	.1506862E+03	.2963276E+03	.5085407E+03
2.000	.4485755E+03	.7540654E+05	0.	0.	.2865189E+03	.8784561E+02	.3085555E+03	.5848710E+03
2.200	.4857461E+03	.8682986E+05	0.	0.	.3370407E+03	.4494276E+02	.3159622E+03	.6612273E+03
2.400	.5241183E+03	.1024251E+06	0.	0.	.3978652E+03	.1116592E+03	.3146848E+03	.7408857E+03
2.600	.5590314E+03	.1180492E+06	0.	0.	.4702693E+03	.2322718E+03	.2943285E+03	.8359691E+03
2.800	.5822015E+03	.1314237E+06	0.	0.	.5631627E+03	.3462067E+03	.2186136E+03	.9770960E+03
3.000	.5398190E+03	.2936841E+06	0.	0.	.7760335E+03	.6754356E+03	.1580181E+03	.1378945E+04
3.100	.5913799E+03	.4659165E+06	0.	0.	.1056700E+04	.9648643E+03	.8188681E+03	.1640299E+04
3.200	.8108739E+03	.3221801E+06	0.	0.	.9085188E+03	.6505814E+03	.9574627E+03	.9679627E+03
3.300	.8149764E+03	.1958272E+06	0.	0.	.8034912E+03	.4815965E+03	.8074323E+03	.7293826E+03
3.400	.8435712E+03	.1368198E+06	0.	0.	.7868883E+03	.4710954E+03	.7202396E+03	.7245673E+03
3.500	.8541792E+03	.1035451E+06	0.	0.	.7943097E+03	.5010467E+03	.6671129E+03	.7617586E+03
3.600	.8659359E+03	.8255123E+05	0.	0.	.8079194E+03	.5413582E+03	.6292716E+03	.8078465E+03
3.700	.8776135E+03	.7144561E+05	0.	0.	.8218683E+03	.5888004E+03	.5982663E+03	.8577787E+03
3.800	.8885114E+03	.7163286E+05	0.	0.	.8337574E+03	.6356521E+03	.5699790E+03	.9111378E+03
3.900	.8982150E+03	.7933712E+05	0.	0.	.8424694E+03	.6826703E+03	.5422616E+03	.9680148E+03
4.000	.9166634E+03	.9477185E+05	0.	0.	.8474994E+03	.7244701E+03	.5139763E+03	.1028271E+04
4.100	.9139911E+03	.1141797E+06	0.	0.	.8487031E+03	.7758681E+03	.4845593E+03	.1091463E+04
4.200	.9204914E+03	.1357552E+06	0.	0.	.8481752E+03	.8217560E+03	.4537937E+03	.1156935E+04
4.300	.9265696E+03	.1584229E+06	0.	0.	.8401732E+03	.8670527E+03	.4210774E+03	.1223935E+04
4.400	.9320968E+03	.1815237E+06	0.	0.	.8310583E+03	.9116851E+03	.3883391E+03	.1291712E+04
4.500	.9393700E+03	.2046330E+06	0.	0.	.8198475E+03	.9555821E+03	.3539628E+03	.1359586E+04
4.600	.9470802E+03	.2274689E+06	0.	0.	.8081761E+03	.9986727E+03	.3188547E+03	.1426986E+04

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FREQ HZ	1	2	3	4	5	6	7	8
4.700	.5562860E+03	.2498443E+06	0.	0.	.7892685E+03	.1040887E+04	.2832281E+03	.1493482E+04
4.800	.9673397E+03	.2711386E+06	0.	0.	.7719188E+03	.1082156E+04	.2474674E+03	.1553683E+04
4.900	.9837723E+03	.2927792E+06	0.	0.	.7534797E+03	.1122416E+04	.2117811E+03	.1622422E+04
5.000	.9960736E+03	.3132286E+06	0.	0.	.7342572E+03	.1161605E+04	.1768737E+03	.1684539E+04
5.200	.1037736E+04	.3520229E+06	0.	0.	.6944513E+03	.1236546E+04	.1132167E+03	.1800679E+04
5.400	.1089538E+04	.3861023E+06	0.	0.	.6540562E+03	.1306577E+04	.7970451E+02	.1918060E+04
5.600	.1154792E+04	.4219772E+06	0.	0.	.6140508E+03	.1371366E+04	.1098451E+03	.2022038E+04
5.800	.1232596E+04	.4529091E+06	0.	0.	.5749709E+03	.1430630E+04	.1763068E+03	.2122081E+04
6.000	.1321419E+04	.4918472E+06	0.	0.	.5351470E+03	.1481291E+04	.2463830E+03	.2215842E+04
6.200	.1423514E+04	.5095846E+06	0.	0.	.4994289E+03	.1531623E+04	.3237581E+03	.2304877E+04
6.400	.1530513E+04	.5352995E+06	0.	0.	.4643008E+03	.1572889E+04	.4026384E+03	.2386606E+04
6.600	.1661532E+04	.5597401E+06	0.	0.	.4327009E+03	.1607644E+04	.4824363E+03	.2448505E+04
6.800	.1773793E+04	.5813588E+06	0.	0.	.4051673E+03	.1635576E+04	.5627465E+03	.2505062E+04
7.000	.1948516E+04	.6053619E+06	0.	0.	.3819918E+03	.1656552E+04	.6443602E+03	.2601853E+04
7.200	.2110933E+04	.6267311E+06	0.	0.	.3632987E+03	.1669019E+04	.7236322E+03	.2680010E+04
7.400	.2283791E+04	.6470785E+06	0.	0.	.3490619E+03	.1675004E+04	.8040342E+03	.2758185E+04
7.600	.2469102E+04	.6564390E+06	0.	0.	.3391035E+03	.1672117E+04	.8855371E+03	.2826408E+04
7.800	.2665475E+04	.6816889E+06	0.	0.	.3330948E+03	.1665493E+04	.9619144E+03	.2886848E+04
8.000	.2871934E+04	.7016749E+06	0.	0.	.3305709E+03	.1654672E+04	.1038545E+04	.2935849E+04
8.200	.3087185E+04	.7171909E+06	0.	0.	.3309555E+03	.1609689E+04	.1112715E+04	.2987138E+04
8.400	.3309334E+04	.7309744E+06	0.	0.	.3336083E+03	.1569605E+04	.1183545E+04	.3033748E+04
8.600	.3539074E+04	.7427037E+06	0.	0.	.3378554E+03	.1519278E+04	.1249974E+04	.3069286E+04
8.800	.3764293E+04	.7519914E+06	0.	0.	.3430301E+03	.1458436E+04	.1310707E+04	.3097699E+04
9.000	.3991490E+04	.7554948E+06	0.	0.	.3475190E+03	.1380569E+04	.1361136E+04	.3106552E+04
9.200	.4207425E+04	.7510542E+06	0.	0.	.3538014E+03	.1304199E+04	.1407484E+04	.3122520E+04
9.400	.4414745E+04	.7601403E+06	0.	0.	.3580343E+03	.1211543E+04	.1440984E+04	.3116197E+04
9.600	.4607390E+04	.7550749E+06	0.	0.	.3605365E+03	.1110237E+04	.1464704E+04	.3096923E+04
9.800	.4781932E+04	.7479413E+06	0.	0.	.3608711E+03	.1001667E+04	.1478395E+04	.3064553E+04
10.000	.4935177E+04	.7360850E+06	0.	0.	.3587712E+03	.8875314E+03	.1481874E+04	.3018488E+04
10.200	.5064241E+04	.7211600E+06	0.	0.	.3541413E+03	.7696323E+03	.1475220E+04	.2959818E+04
10.400	.5167270E+04	.7031491E+06	0.	0.	.3470307E+03	.6500037E+03	.1458801E+04	.2889402E+04
10.600	.5243597E+04	.6824623E+06	0.	0.	.3376409E+03	.5307063E+03	.1433320E+04	.2808645E+04
10.800	.5293817E+04	.6559165E+06	0.	0.	.3262936E+03	.4137322E+03	.1399788E+04	.2720220E+04
11.000	.5319722E+04	.6352023E+06	0.	0.	.3134021E+03	.3009232E+03	.1359463E+04	.2625951E+04
11.200	.5324125E+04	.6098431E+06	0.	0.	.2994373E+03	.1940330E+03	.1313757E+04	.2528599E+04
11.400	.5310604E+04	.5841578E+06	0.	0.	.2848955E+03	.9573075E+02	.1264150E+04	.2430768E+04
11.600	.5283295E+04	.5587320E+06	0.	0.	.2702724E+03	.3419951E+02	.1212112E+04	.2334959E+04
11.800	.5240521E+04	.5341095E+06	0.	0.	.2560536E+03	.9774467E+02	.1159060E+04	.2243569E+04
12.000	.5189454E+04	.5061094E+06	0.	0.	.2421963E+03	.1783377E+03	.1107860E+04	.2149822E+04
12.200	.5168764E+04	.4895210E+06	0.	0.	.2310391E+03	.2444672E+03	.1058012E+04	.2085100E+04
12.400	.5130605E+04	.4702743E+06	0.	0.	.2207602E+03	.3092565E+03	.1007682E+04	.2020824E+04
12.600	.5095835E+04	.4524822E+06	0.	0.	.2116419E+03	.3677089E+03	.9610819E+03	.1960039E+04
12.800	.5062688E+04	.4361156E+06	0.	0.	.2035931E+03	.4209179E+03	.9162443E+03	.1914615E+04
13.000	.5031486E+04	.4210724E+06	0.	0.	.1965436E+03	.4694641E+03	.8732259E+03	.1871750E+04
13.200	.5002379E+04	.4072541E+06	0.	0.	.1904191E+03	.5138897E+03	.8320977E+03	.1834893E+04
13.400	.4975477E+04	.3945607E+06	0.	0.	.1851344E+03	.5546874E+03	.7928942E+03	.1803460E+04
13.600	.4950662E+04	.3528912E+06	0.	0.	.1805936E+03	.5922962E+03	.7558359E+03	.1776848E+04

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FREQ HZ	1	2	3	4	5	6	7	8
13.800	.4927699E+04	.3721441E+06	0.	0.	.1766911E+03	.8271003E+03	.7203308E+03	.1754610E+04
14.000	.4906229E+04	.3622100E+06	0.	0.	.1733140E+03	.6594417E+03	.6869606E+03	.1738059E+04
14.200	.4885770E+04	.3550148E+06	0.	0.	.1703438E+03	.6695738E+03	.6559875E+03	.1720868E+04
14.400	.4865750E+04	.3444391E+06	0.	0.	.1676573E+03	.7177655E+03	.6261605E+03	.1707880E+04
14.600	.4845418E+04	.3363844E+06	0.	0.	.1651248E+03	.7442067E+03	.5987236E+03	.1697030E+04
14.800	.4823813E+04	.3247532E+06	0.	0.	.1626038E+03	.7690653E+03	.5733281E+03	.1687505E+04
15.000	.4770880E+04	.3200044E+06	0.	0.	.1600475E+03	.7945476E+03	.5467329E+03	.1674876E+04
15.200	.4791465E+04	.3160032E+06	0.	0.	.1567455E+03	.8099883E+03	.5359356E+03	.1666043E+04
15.400	.4734420E+04	.3069633E+06	0.	0.	.1531281E+03	.8353654E+03	.5108839E+03	.1656870E+04
15.600	.4697477E+04	.3000615E+06	0.	0.	.1493169E+03	.8544071E+03	.4944799E+03	.1648882E+04
15.800	.4658279E+04	.2934518E+06	0.	0.	.1453550E+03	.8729401E+03	.4729924E+03	.1635360E+04
16.000	.4617666E+04	.2871450E+06	0.	0.	.1412748E+03	.8895063E+03	.4673445E+03	.1625428E+04
16.200	.4575910E+04	.2811408E+06	0.	0.	.1370930E+03	.9054492E+03	.4568674E+03	.1610139E+04
16.400	.4533221E+04	.2754318E+06	0.	0.	.1328167E+03	.9199110E+03	.4473906E+03	.1607499E+04
16.600	.4489697E+04	.2700081E+06	0.	0.	.1284459E+03	.9332307E+03	.4400813E+03	.1599494E+04
16.800	.4445427E+04	.2648545E+06	0.	0.	.1239749E+03	.9454438E+03	.4345355E+03	.1592090E+04
17.000	.4400495E+04	.2599625E+06	0.	0.	.1193972E+03	.9565815E+03	.4367511E+03	.1588248E+04
17.200	.4354794E+04	.2553101E+06	0.	0.	.1148800E+03	.9666701E+03	.4288850E+03	.1576922E+04
17.400	.4308451E+04	.2508822E+06	0.	0.	.1098130E+03	.9757303E+03	.4289335E+03	.1573065E+04
17.600	.4261175E+04	.2466605E+06	0.	0.	.1047552E+03	.9837758E+03	.4510836E+03	.1566824E+04
17.800	.4213497E+04	.2426249E+06	0.	0.	.9945311E+02	.9908088E+03	.4355117E+03	.1562570E+04
18.000	.4144841E+04	.2386591E+06	0.	0.	.9194654E+02	.9972284E+03	.4476594E+03	.1557690E+04
18.200	.4117936E+04	.2361678E+06	0.	0.	.9106479E+02	.1001272E+04	.4434751E+03	.1555625E+04
18.400	.4065117E+04	.2313684E+06	0.	0.	.8092939E+02	.1005491E+04	.4469017E+03	.1549341E+04
18.600	.4019915E+04	.2276504E+06	0.	0.	.7392073E+02	.1008434E+04	.4831588E+03	.1545584E+04
18.800	.3959134E+04	.2244451E+06	0.	0.	.6667411E+02	.1010579E+04	.5014881E+03	.1542108E+04
19.000	.3904836E+04	.2211512E+06	0.	0.	.5924168E+02	.1011979E+04	.5215830E+03	.1538968E+04
19.200	.3851146E+04	.2179618E+06	0.	0.	.5166370E+02	.1012672E+04	.5431722E+03	.1536131E+04
19.400	.3797215E+04	.2148732E+06	0.	0.	.4397385E+02	.1012886E+04	.5660028E+03	.1533380E+04
19.600	.3743370E+04	.2118817E+06	0.	0.	.3620209E+02	.1012034E+04	.5808516E+03	.1531288E+04
19.800	.3688809E+04	.2089835E+06	0.	0.	.2837690E+02	.1010724E+04	.6144202E+03	.1529220E+04
20.000	.3634588E+04	.2061744E+06	0.	0.	.2052818E+02	.1008749E+04	.6395249E+03	.1527326E+04
20.200	.3580219E+04	.2034508E+06	0.	0.	.1269497E+02	.1006090E+04	.6649128E+03	.1525548E+04
20.400	.3526049E+04	.2008084E+06	0.	0.	.5019481E+01	.1002710E+04	.6903094E+03	.1523807E+04
20.600	.3472066E+04	.1982430E+06	0.	0.	.3502832E+01	.9985491E+03	.7154275E+03	.1522000E+04
20.800	.3418291E+04	.1957491E+06	0.	0.	.1092772E+02	.9935024E+03	.7309188E+03	.1519868E+04
21.000	.3364545E+04	.1926830E+06	0.	0.	.2156379E+02	.9839834E+03	.7731774E+03	.1516992E+04
21.200	.3343688E+04	.1917098E+06	0.	0.	.2178478E+02	.9846576E+03	.7723754E+03	.1515284E+04
21.400	.3258936E+04	.1886017E+06	0.	0.	.3291941E+02	.9703280E+03	.8034494E+03	.1509862E+04
21.600	.3206764E+04	.1865427E+06	0.	0.	.3980855E+02	.9602261E+03	.8212196E+03	.1505056E+04
21.800	.3155210E+04	.1841673E+06	0.	0.	.4676473E+02	.9495798E+03	.8379215E+03	.1499894E+04
22.000	.3104445E+04	.1820827E+06	0.	0.	.5353206E+02	.9388018E+03	.8557422E+03	.1494505E+04
22.200	.3054480E+04	.1800949E+06	0.	0.	.6020820E+02	.9274655E+03	.8889662E+03	.1488970E+04
22.400	.3005437E+04	.1782093E+06	0.	0.	.6679696E+02	.9163227E+03	.8835492E+03	.1483169E+04
22.600	.2957416E+04	.1764311E+06	0.	0.	.7329878E+02	.9053120E+03	.8976290E+03	.1477778E+04
22.800	.2910525E+04	.1747654E+06	0.	0.	.7971227E+02	.8945641E+03	.9112821E+03	.1472286E+04
23.000	.2864880E+04	.1732173E+06	0.	0.	.8601327E+02	.8842065E+03	.9245773E+03	.1466915E+04

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FREQ HZ	1	2	3	4	5	6	7	8
23.200	.2820638E+04	.1717918E+06	0.	0.	.9225573E+02	.8746070E+03	.9375789E+03	.1461608E+04
23.400	.2777944E+04	.1704947E+06	0.	0.	.9837097E+02	.8651788E+03	.9503497E+03	.1457040E+04
23.600	.2737008E+04	.1693321E+06	0.	0.	.1043669E+03	.8567880E+03	.9629495E+03	.1452722E+04
23.800	.2699103E+04	.1683120E+06	0.	0.	.1102262E+03	.8493686E+03	.9754488E+03	.1449000E+04
24.000	.2643963E+04	.1672659E+06	0.	0.	.1180061E+03	.8406575E+03	.9943493E+03	.1445598E+04

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FREQ HZ	9	10
.050	.4867255E+01	.3407794E+01
.100	.1816255E+02	.1260864E+02
.150	.3543193E+02	.2565106E+02
.200	.4409848E+02	.3273744E+02
.250	.4776265E+02	.3471856E+02
.300	.4998395E+02	.3481017E+02
.350	.5168300E+02	.3340558E+02
.400	.5371377E+02	.3114819E+02
.450	.5563486E+02	.2825651E+02
.500	.5765899E+02	.2491523E+02
.550	.5979617E+02	.2134170E+02
.600	.6294790E+02	.1788029E+02
.650	.6441281E+02	.1516283E+02
.700	.6688634E+02	.1420913E+02
.750	.6947220E+02	.1584023E+02
.800	.7216281E+02	.1979070E+02
.850	.7495836E+02	.2526635E+02
.900	.7780034E+02	.3171042E+02
.950	.8080756E+02	.3874233E+02
1.000	.8398156E+02	.4659148E+02
1.200	.9794465E+02	.6043703E+02
1.400	.1134177E+03	.1189210E+03
1.600	.1312608E+03	.1631358E+03
1.800	.1535617E+03	.2155709E+03
2.000	.1819956E+03	.2794624E+03
2.200	.2200628E+03	.3622916E+03
2.400	.2753246E+03	.4781638E+03
2.600	.3663271E+03	.6631747E+03
2.800	.5555413E+03	.1039538E+04
3.000	.1189860E+04	.2289386E+04
3.100	.1845630E+04	.3009603E+04
3.200	.1207304E+04	.2360452E+04
3.300	.6881704E+03	.1380697E+04
3.400	.4014711E+03	.9409993E+03
3.500	.3474813E+03	.7234717E+03
3.600	.2863810E+03	.6098479E+03

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FREQ HZ	9	10
3,700	,2537625E+03	,5533942E+03
3,800	,2479927E+03	,5530984E+03
3,900	,2325194E+03	,5276065E+03
4,000	,2334013E+03	,5414117E+03
4,100	,2362640E+03	,5613906E+03
4,200	,2456198E+03	,5804527E+03
4,300	,2545510E+03	,6145658E+03
4,400	,2645079E+03	,6447150E+03
4,500	,2754696E+03	,6761254E+03
4,600	,2869779E+03	,7081007E+03
4,700	,2990697E+03	,7434211E+03
4,800	,3110667E+03	,7729814E+03
4,900	,3244134E+03	,8053462E+03
5,000	,3394415E+03	,8377359E+03
5,200	,3671316E+03	,8926810E+03
5,400	,3979125E+03	,9656895E+03
5,600	,4306326E+03	,1026458E+04
5,800	,4652488E+03	,1090310E+04
6,000	,5025586E+03	,1151943E+04
6,200	,5394099E+03	,1210632E+04
6,400	,5796604E+03	,1266911E+04
6,600	,6215218E+03	,1325944E+04
6,800	,6641745E+03	,1381580E+04
7,000	,7042237E+03	,1435560E+04
7,200	,7512316E+03	,1487625E+04
7,400	,7989173E+03	,1537363E+04
7,600	,8448324E+03	,1584105E+04
7,800	,8907595E+03	,1627414E+04
8,000	,9359734E+03	,1666473E+04
8,200	,9779931E+03	,1700478E+04
8,400	,1021784E+04	,1724368E+04
8,600	,1060713E+04	,1744923E+04
8,800	,1095636E+04	,1761148E+04
9,000	,1123590E+04	,1759755E+04
9,200	,1147510E+04	,1752913E+04
9,400	,1162316E+04	,1730450E+04
9,600	,1169531E+04	,1690146E+04
9,800	,1168880E+04	,1650183E+04
10,000	,1160212E+04	,1592999E+04
10,200	,1143611E+04	,1525410E+04
10,400	,1119443E+04	,1448645E+04
10,600	,1088172E+04	,1364312E+04
10,800	,1051315E+04	,1274425E+04
11,000	,1009480E+04	,1181110E+04
11,200	,9641606E+03	,1086707E+04
11,400	,9165630E+03	,9935945E+03
11,600	,8682604E+03	,9041746E+03

DATE
TIME

INT, LOADS - MODULUS

INT, LOAD NO,

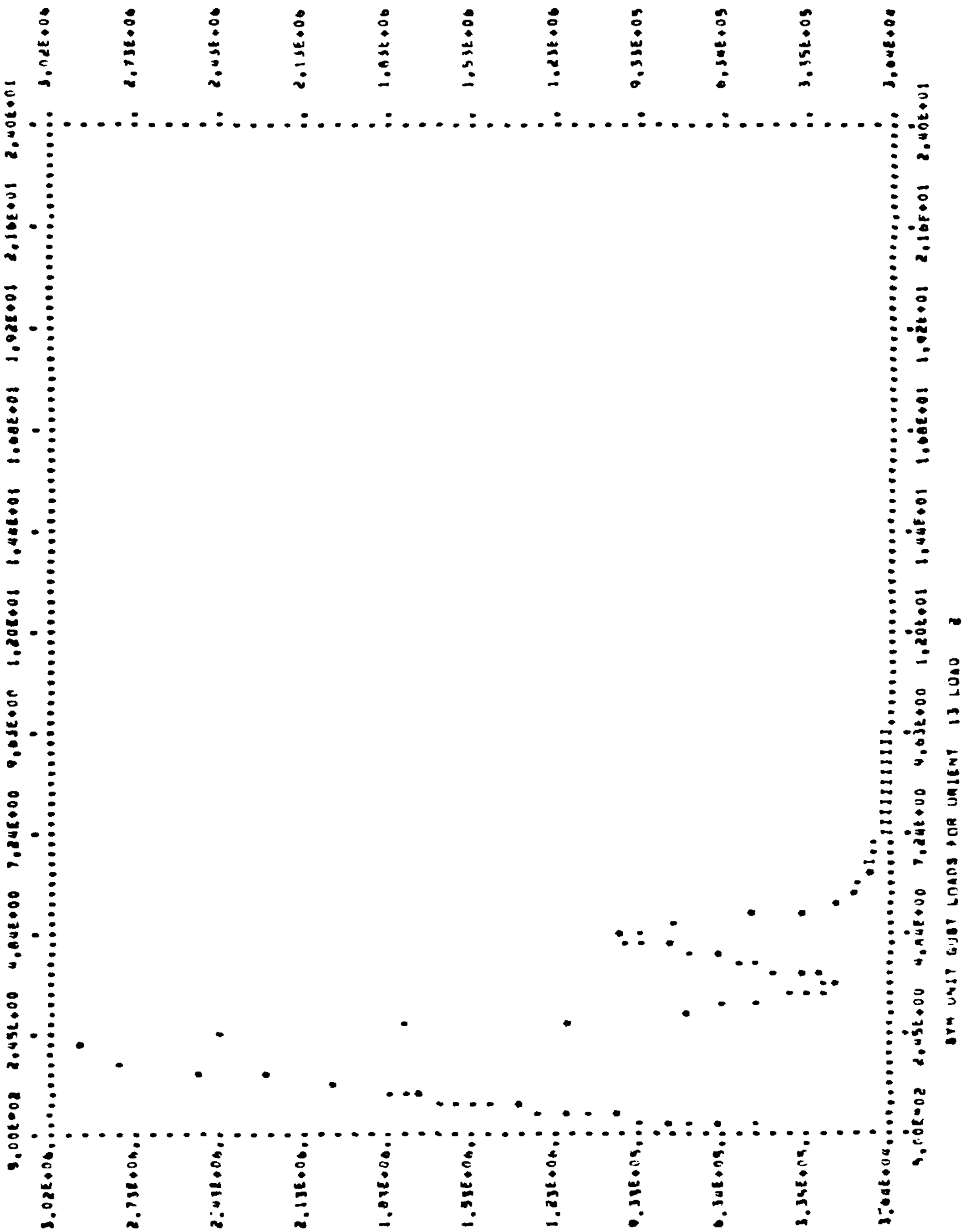
FREQ HZ	9	10
11,800	,8265954E+03	,8219978E+03
12,000	,7712710E+03	,7433862E+03
12,200	,7337739E+03	,6635111E+03
12,400	,6968930E+03	,6343957E+03
12,600	,6659178E+03	,6021368E+03
12,800	,6374661E+03	,5823656E+03
13,000	,6161199E+03	,5810792E+03
13,200	,6010362E+03	,5952336E+03
13,400	,5924509E+03	,6227126E+03
13,600	,59[illegible]2E+03	,6606873E+03
13,800	,5945705E+03	,7071962E+03
14,000	,6044541E+03	,7594379E+03
14,200	,6193195E+03	,8155769E+03
14,400	,6383169E+03	,8751715E+03
14,600	,6615679E+03	,9363628E+03
14,800	,6852163E+03	,9987352E+03
15,000	,7225111E+03	,1062285E+04
15,200	,7123387E+03	,1083594E+04
15,400	,7633191E+03	,1188772E+04
15,600	,7895104E+03	,1252428E+04
15,800	,8197654E+03	,1316224E+04
16,000	,8427[illegible]E+03	,1380078E+04
16,200	,8697340E+03	,1441958E+04
16,400	,8971592E+03	,1507811E+04
16,600	,9247653E+03	,1571584E+04
16,800	,9527656E+03	,1635104E+04
17,000	,9816488E+03	,1695540E+04
17,200	,1009725E+04	,1761483E+04
17,400	,1038656E+04	,1823886E+04
17,600	,1068787E+04	,1885453E+04
17,800	,1097530E+04	,1945932E+04
18,000	,1138761E+04	,2024718E+04
18,200	,1136872E+04	,2082466E+04
18,400	,1187079E+04	,2114582E+04
18,600	,1217167E+04	,2169216E+04
18,800	,1247159E+04	,2210418E+04
19,000	,1276968E+04	,2265268E+04
19,200	,1306597E+04	,2312913E+04
19,400	,1335684E+04	,2354619E+04
19,600	,1364425E+04	,2405435E+04
19,800	,1392614E+04	,2455537E+04
20,000	,1420135E+04	,2495077E+04
20,200	,1448302E+04	,2539216E+04
20,400	,1472727E+04	,2583136E+04
20,600	,1497439E+04	,2627050E+04
20,800	,1520790E+04	,2671205E+04
21,000	,1550825E+04	,2734678E+04

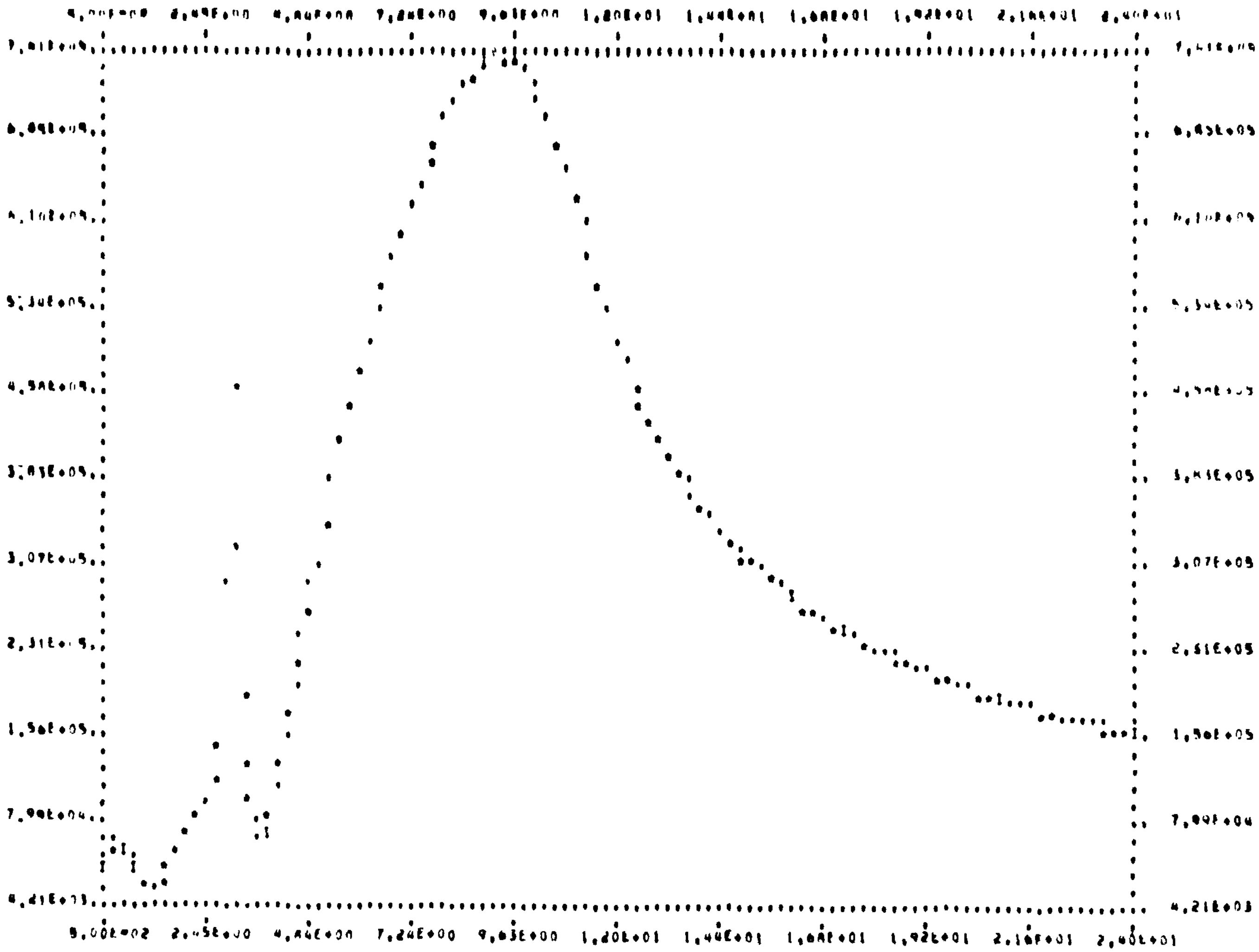
DATE
TIME

INT. LOADS = MODULUS

INT. LOAD NO.

FREQ HZ	9	10
21.200	.1551095E+04	.2736552E+04
21.400	.1577465E+04	.2809336E+04
21.600	.1592148E+04	.2858843E+04
21.800	.1605377E+04	.2910647E+04
22.000	.1617492E+04	.2964768E+04
22.200	.1628887E+04	.3021308E+04
22.400	.1639122E+04	.3080274E+04
22.600	.1648943E+04	.3141605E+04
22.800	.1658290E+04	.3205179E+04
23.000	.1667295E+04	.3270821E+04
23.200	.1676095E+04	.3334292E+04
23.400	.1684834E+04	.3407203E+04
23.600	.1693670E+04	.3477451E+04
23.800	.1702709E+04	.3548291E+04
24.000	.1717344E+04	.3654972E+04


SYM UNIT GUST LOADS FOR ORIENT 13 LOAD 2



ASYM UNIT GUST LOADS FOR ORIENT 13 LOAD 2

TABLE 30

EXAMPLE PROBLEM OUTPUT LISTING

TRIM AND BLAST MODULES

```
                                                                        DATE
                                                                        TIME
            FIXED DATA DECK INPUT GO

            IDENTB         6

            THE FOLLOWING ANALYSIS CODES HAVE BEEN CALLED FOR IN THIS RUN

                                                    BLST


********************
TAPE10 READING

********************
HEADER DATA READ FROM TAPE10
        NM       NSYM      NASYM      NGUST        NR      MACH       HEFA       RPFR      RFFP
        19          7          9         11         2   .85E+00    .81E+06    .99E+03   .30E+03

            INERTIAL DATA

            NO. TOTAL MASSES           =  28
            NO. SYMMETRIC MODES        =   7
            NO. ANTISYMMETRIC MODES    =   9
            NO. ENGINES                =   1
            UNIT LOAD PRNT FLAG        =   0

            FRF DATA DECK INPUT GO

            FLIGHT DATA FOR FREQUENCY RESPONSE AND UNIT GUST LOADS

            VKEAS       =  552.151 KEAS
            ALTITUDE    =   1000.000 FT.
            SIZE FACTOR =   1.0000 INCHES/UNIT
            VTAS        =  906.342 FPS
            DYNAMIC P   = 1033.536 PSF
            SIGMA       =   .97106E+00
            MACH        =    .8506
            PLOT G FLG  =   0
            PLOT GST FLG    2

                 1781 WORDS OF CORE RQD FOR STEP ***  MAIN    ***
```

```
                                                                                          DATE
HEADER DATA READ  FROM TAPE14                                                             TIME
    IDENT     NINTLD    NSTRSS    NENGB     NSVH      NABYM        NK    NARGRP    NABGRP    NBOXES    NAEROB
      6        10                   1         7         9          10        5         6        40         8
                           8137 WORDS OF CORE ROD FOR STEP ***AERO STB  ***
HEADER DATA READ  FROM TAPE3A
    IDENT     NGUST     NFREQ     NINTLD     VEL      SIGMA
      6        13        145        10      946.34     .97
```

```
                                                                DATE
                                                                TIME
RUN DATA FOR TRIM

LOAD FACTOR          =   1.000
TAKEOVER CODE        =   0
ZDOT                 =   0.000 FPS
TRIM MTX PRNT FLG    =   0
RH MODE R.T. CORR.   =  .10000E+04

RUN DATA FOR BLAST

MAX SOL. TIME          =   1.000 SECS
YIELD                  =  10.000 KT
GROUND HEIGHT          =     0.0 FT.
LOAD TIME HSTRY PRNT   =   0
NO. ORIENTATIONS       =   4
GROUND REFL. CODE      =   0
ITERATION CODE         =   1
MOD CRIT LOAD CODE     =   1
MOD CRIT STRSS CODE    =   0
LOAD MTX PRNT FLG      =   0
PLOT BLST LOAD FLG     =   3
INITIAL DELTA T        =    .00200 SECS

       719 WORDS OF CORE RQD FOR STEP ***  TRIM    ***
```

```
                                                                                      DATE
                                                                                      TIME
                AEROELASTIC TRIM SOLUTIONS

                VEL =   552.19 KEAS            ALT =    1000.00 FT.

                           TRIMMED SYMMETRIC FLIGHT SOLNS

         R.B. PLUNGE        MODE =    1
         R.B. PITCH         MODE =    2
         SYMMETRIC TRIM     MODE =    4
         SYM R.B. JIG       MODE =    0
         1ST SYM ELASTIC    MODE =    5
         LST SYM ELASTIC    MODE =    7
         TRUE VELOCITY         =    946.342 FPS
         DYNAMIC PRESSURE      =      7.177 PSI
         LOAD FACTOR           =      1.000
         PITCH RATE            =     0.0000 RAD/SEC

**************************

TAPE34 READ IN

**************************

 GENERALIZED COORDINATES

            Q                  QDOT

    1   0.                     0.
    2    .1151[illegible]E+02    0.
    3   0.                     0.
    4   -.4[illegible]E+01       0.
    5    .15[illegible]E+02      0.
    6    .21[illegible]E+01      0.
    7    .1[illegible]E+01       0.

         ALPHA TRIM            =      .6597 DEG
         DELTA PITCH TRIM      =     -.2451 DEG
```

DATE
TIME

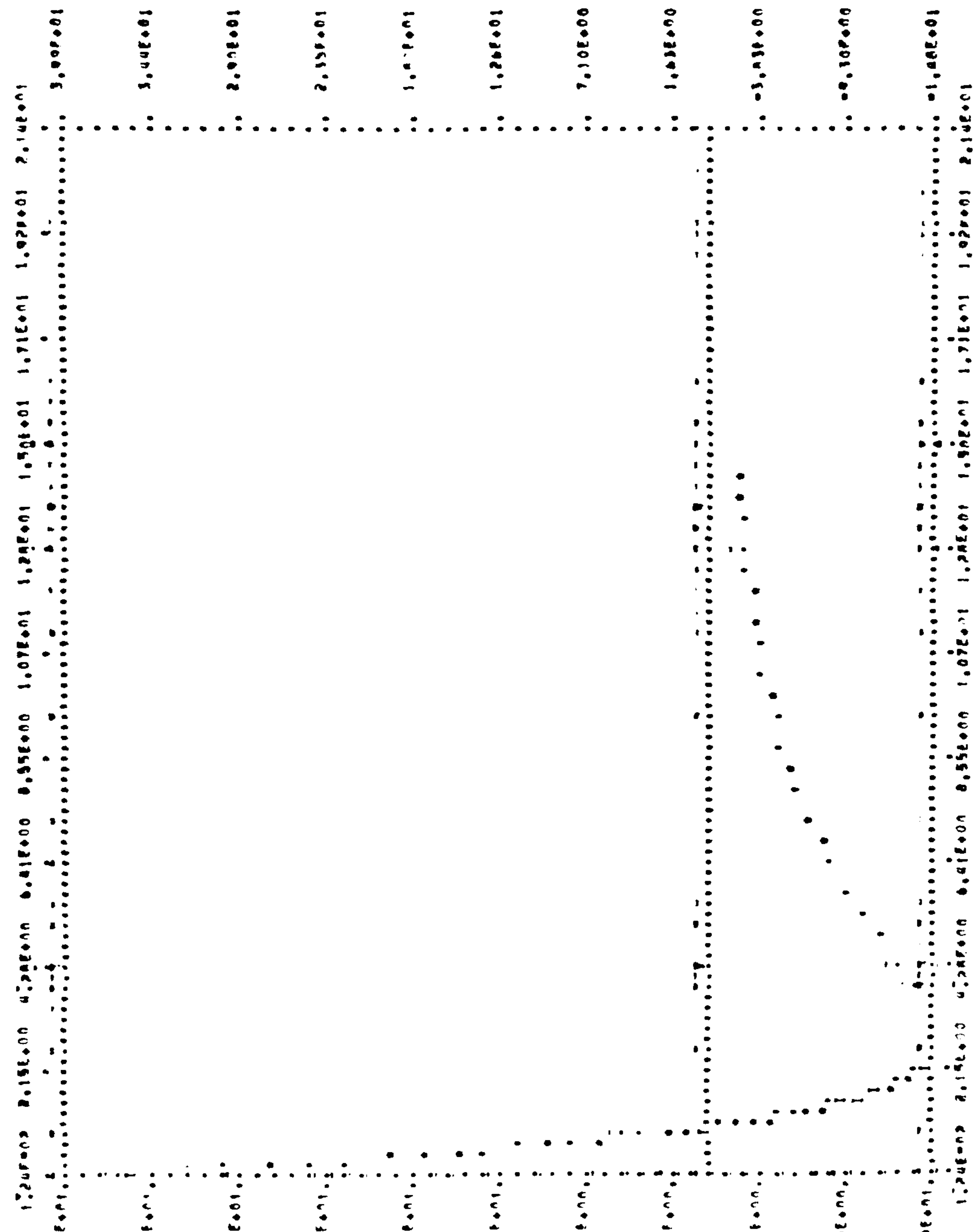
SYM INTEGRATED LOADS FOR TRIM

	1
1	.51772E+05
2	.26509E+08
3	-.78005E+04
4	.41271E+05
5	.16022E+04
6	0.
7	.32753E+05
8	.56882E+05
9	.14213E+04
10	0.

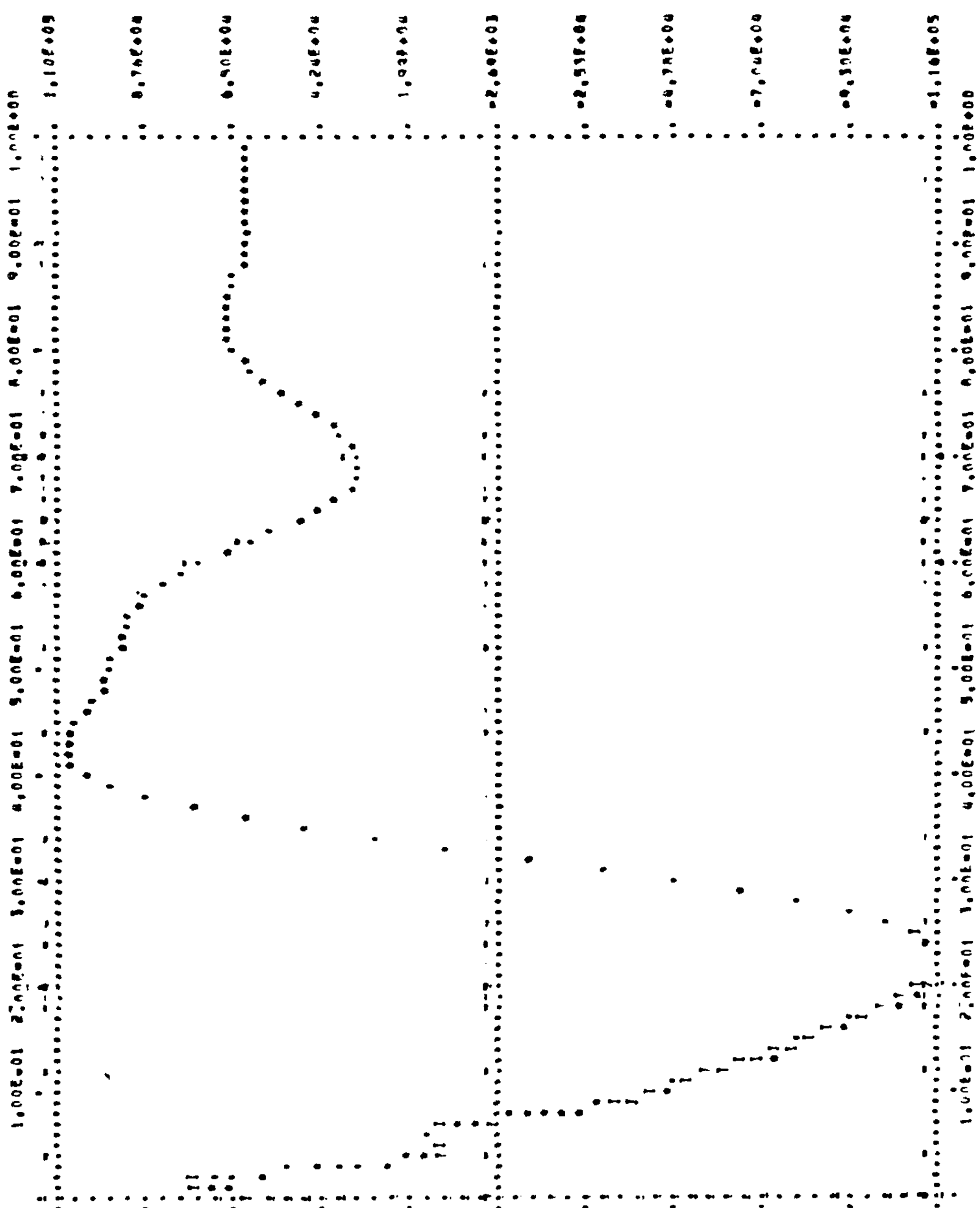
12488 WORDS OF CORE USED FOR STEP *** BLAST ***

DATE
TIME

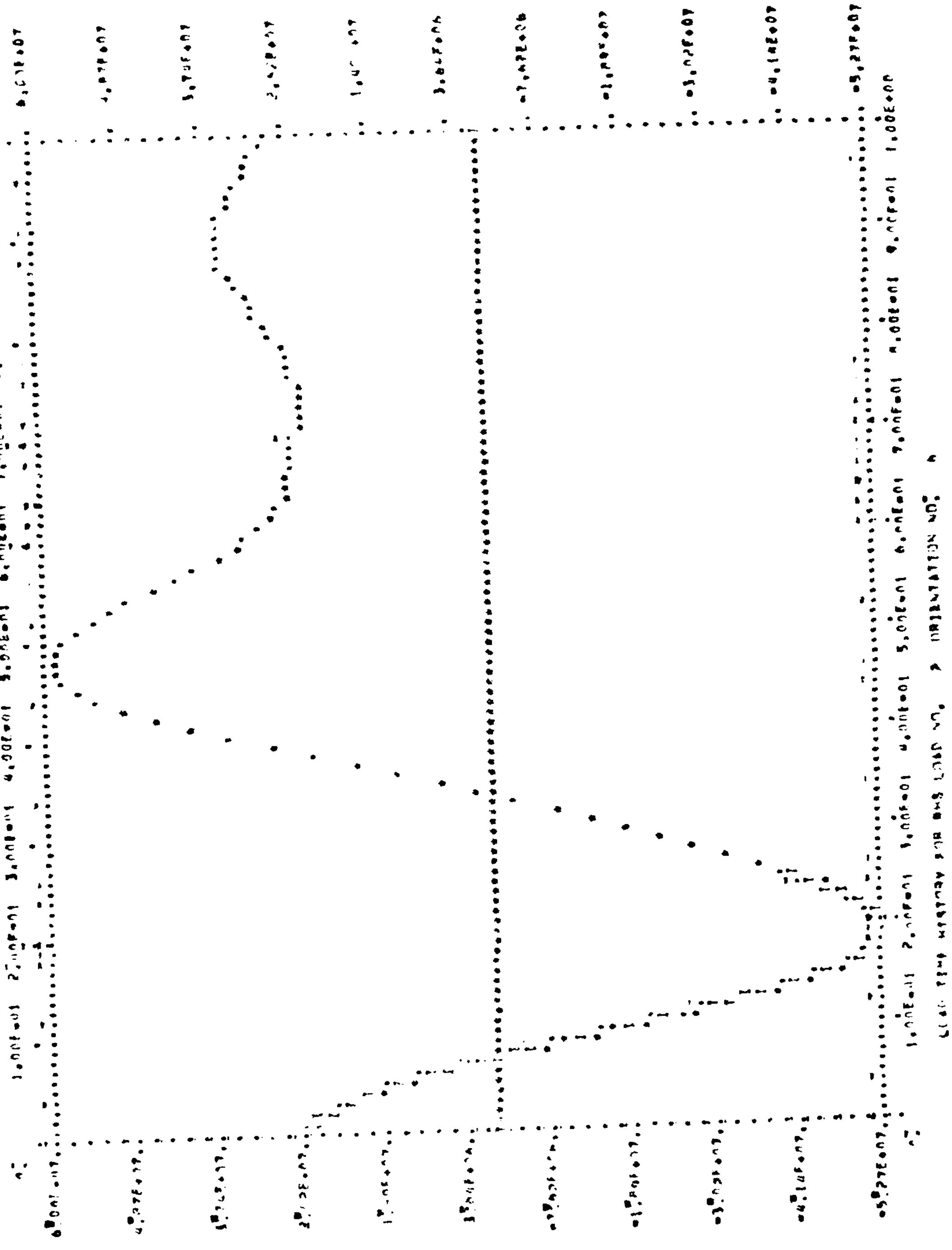
```
BLAST TIME RESPONSE PARAMETERS

NGRD =      0
NCPT =      1
HGRD =      0.00 FT.
ORIENTATION NO. =      0
YIELD           =      10.0000 KILOTONS
BLSTRG          =       10000.0000 FEET
MAX. RESP. TIME =      1.0000 SECS
NO. TIME RSP.PTS=    201
GAMX =  0.
GAMY =  0.
GAMZ =  -.10000E+01
TAU  =      -.0124 SECS
XINT =      1020.53
YINT =      -337.50
ZINT =       165.60

RANGE ITERATION NO.    1

COORDINATES OF AIRCRAFT AND BURST AT TIME =     0.0000 SECS

 AIRCRAFT (FEAS)
X = -0.
Y =  0.
Z =   .10000E+04

BURST (FEAS)
X =   .
Y =  0.
Z =   .11000E+05

DISTANCE BURST TO AIRCRAFT AT INTERCEPT
BLSTRI =    .10000E+05 FT.

DISTANCE BURST TO AIRCRAFT NOW IS
BLSTRG =    .10000E+05 FT.
XE-XR  =  0.          FT.
YE-YR  =  0.          FT.
ZE-ZR  =  -.10000E+05 FT.

TIME BACK TO BURST =     -7.6311 SECS
```

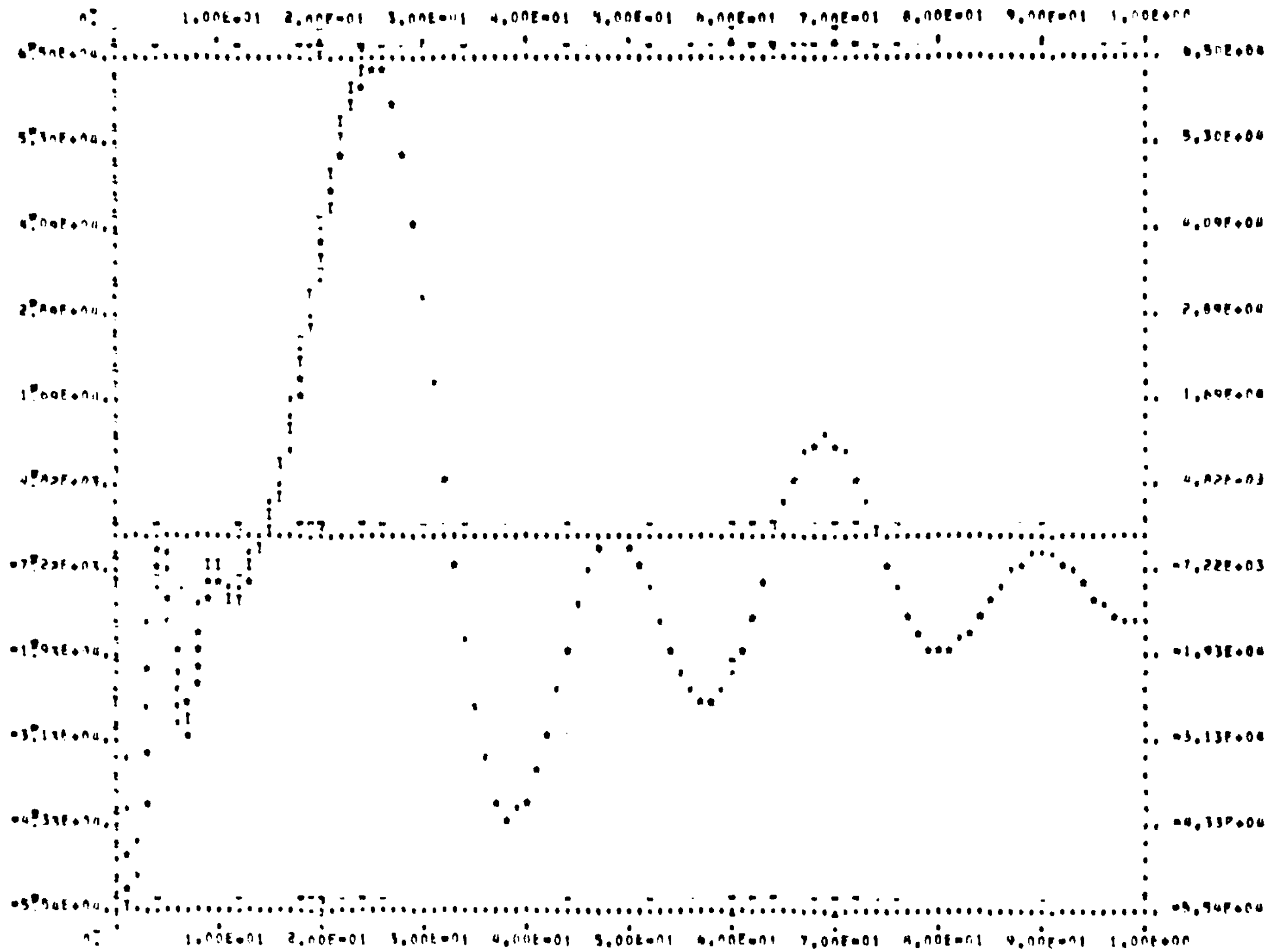


GUST TIME HISTORY AT AAB ORIGIN
EST. FREQ. FOR 0 NOD. OF GUST FUNCTION = 47.17 HZ

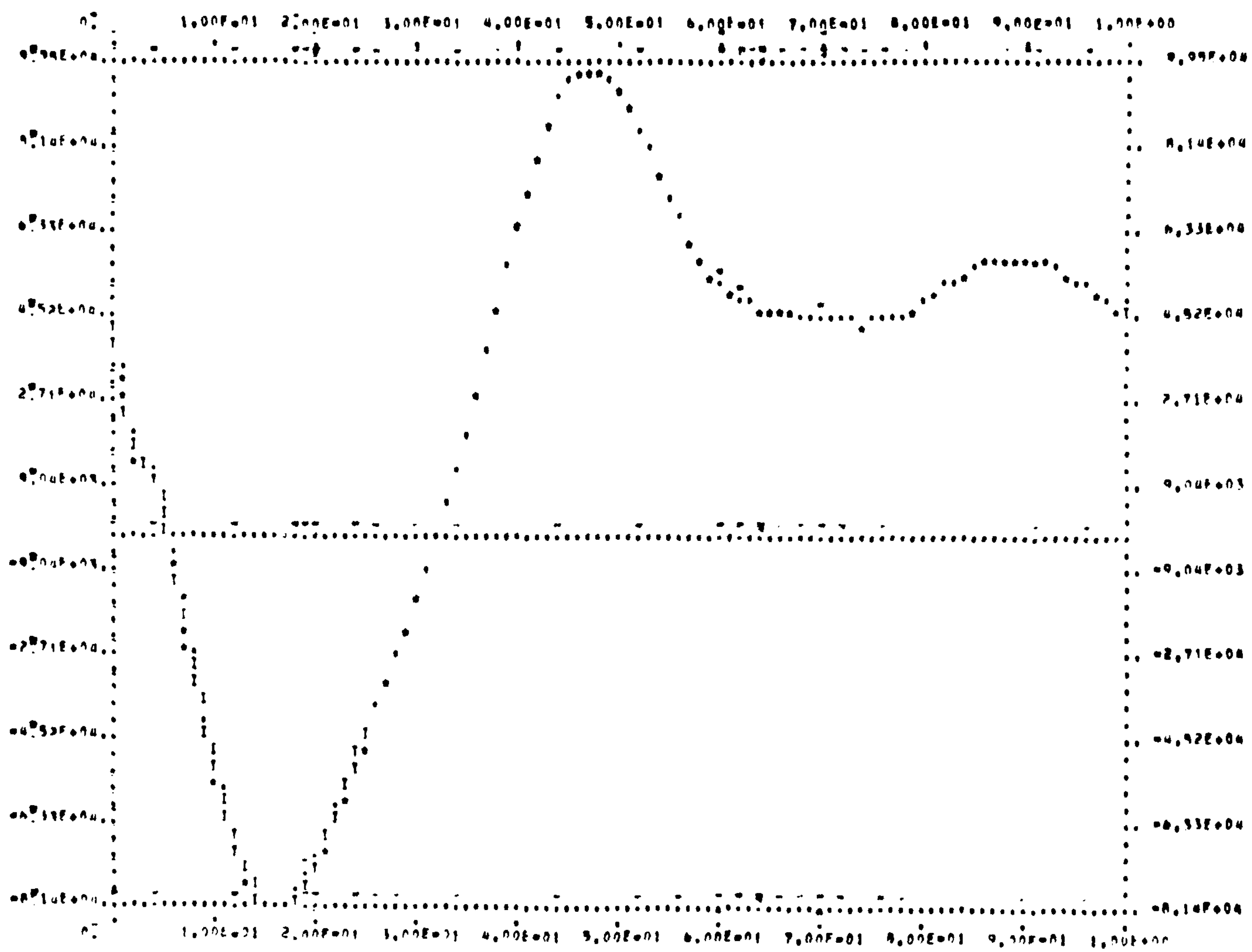


LOAD TIME HISTORY FOR RMS LOAD NO. 1 ORIENTATION NO. 6

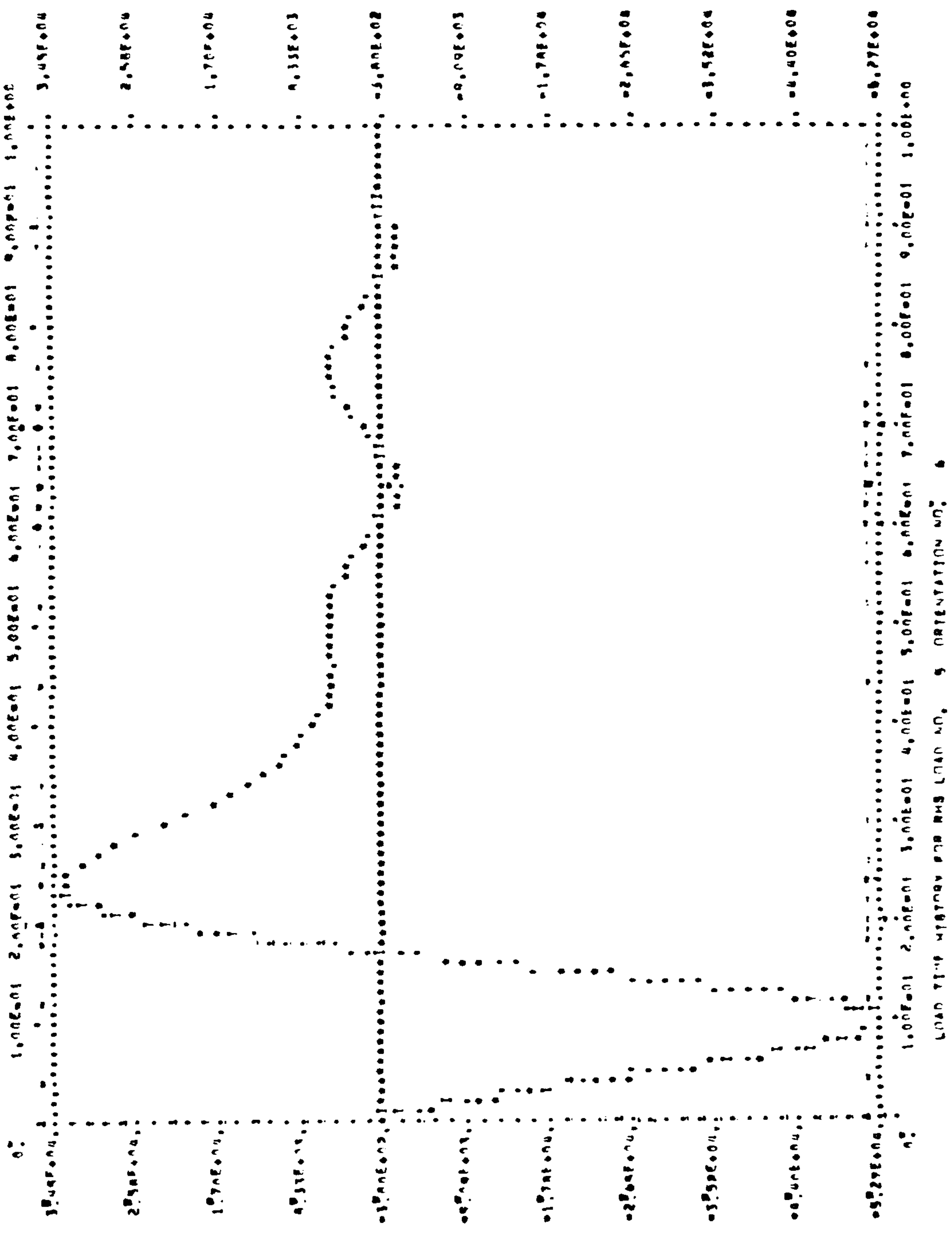


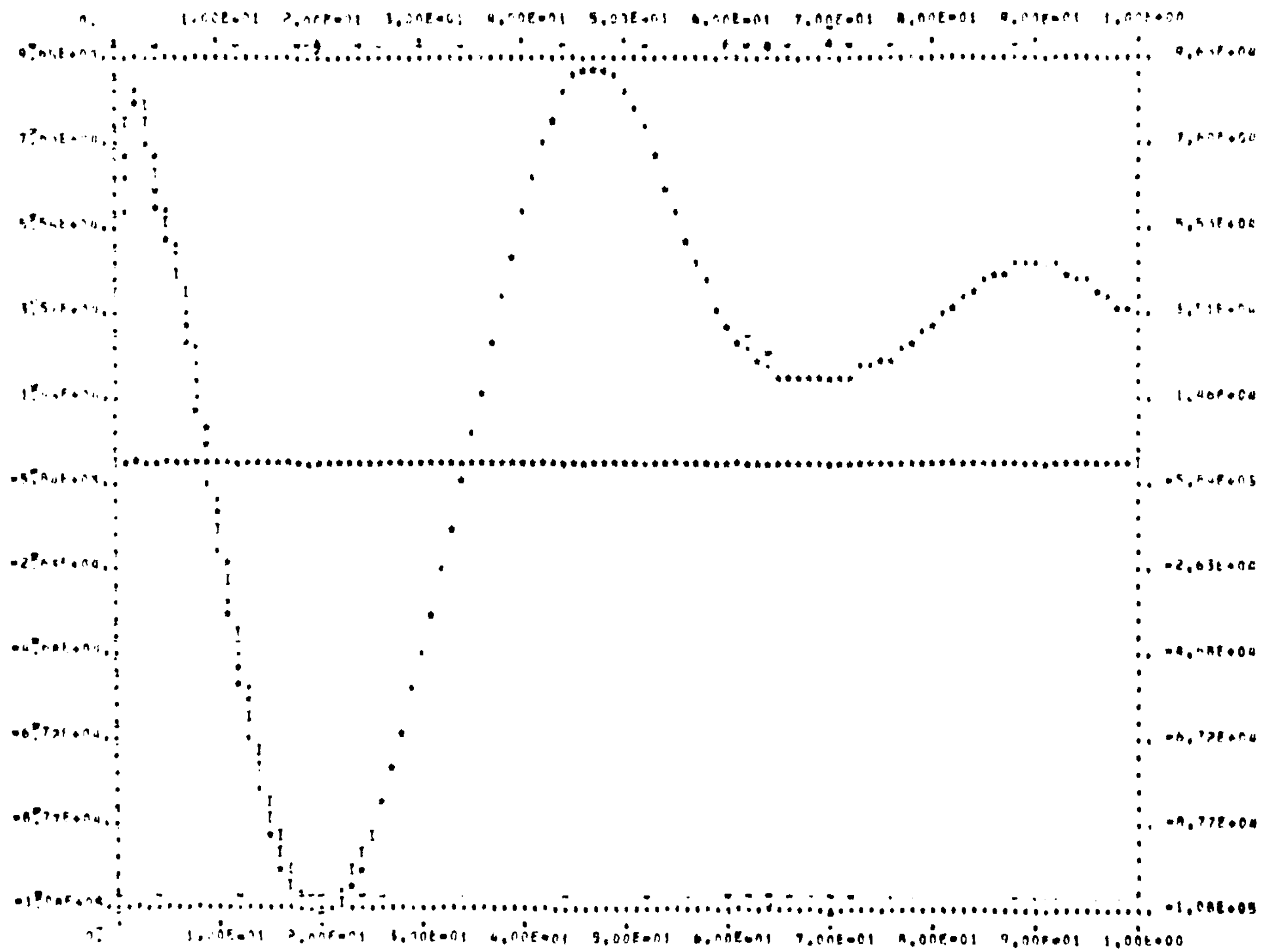


LOAD TIME HISTORY FOR RHR LOAD NO. 3 ORIENTATION NO. 6

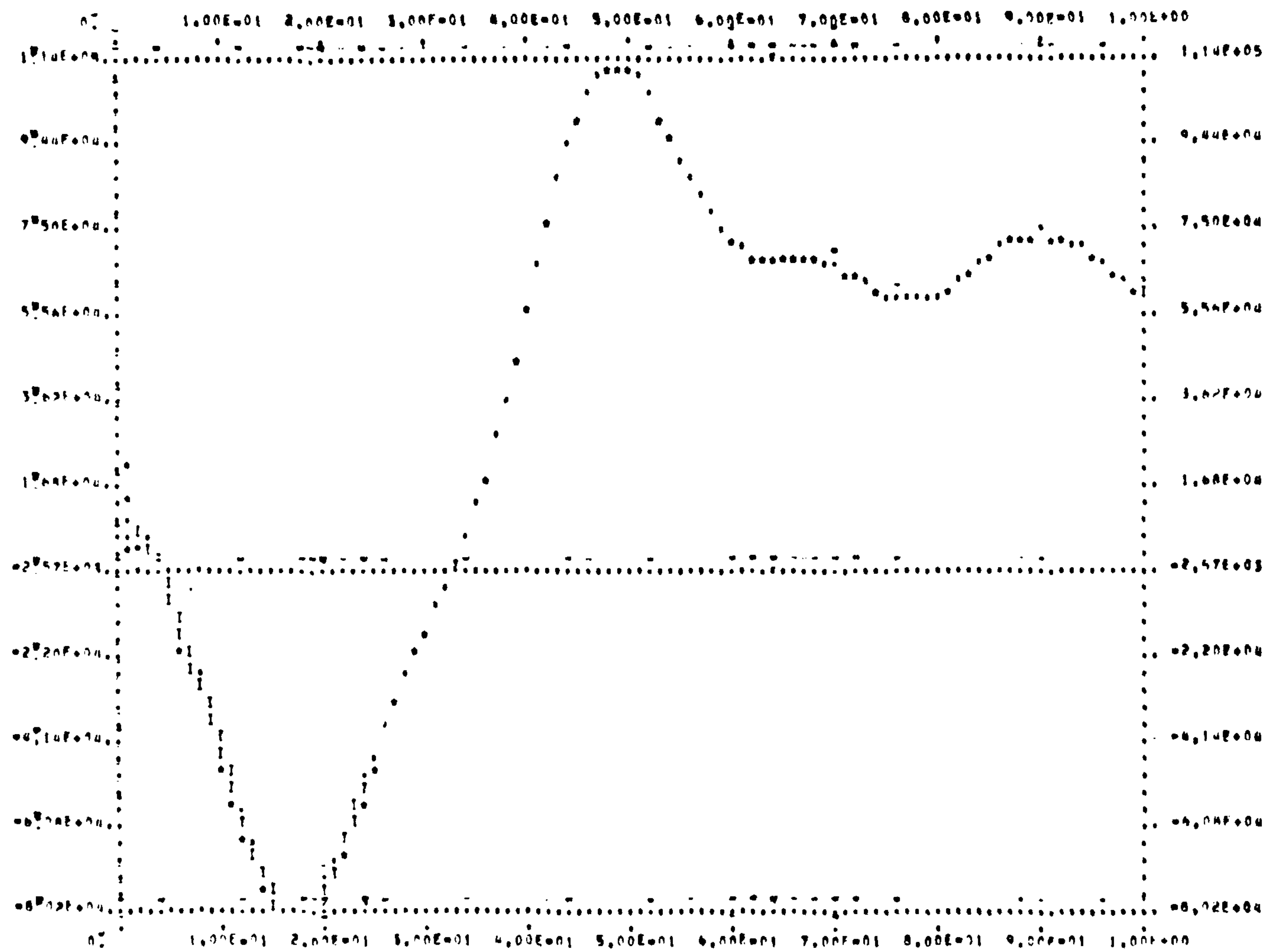


LOAD TIME HISTORY FOR RHB LOAD NO. 4 ORIENTATION NO. 6

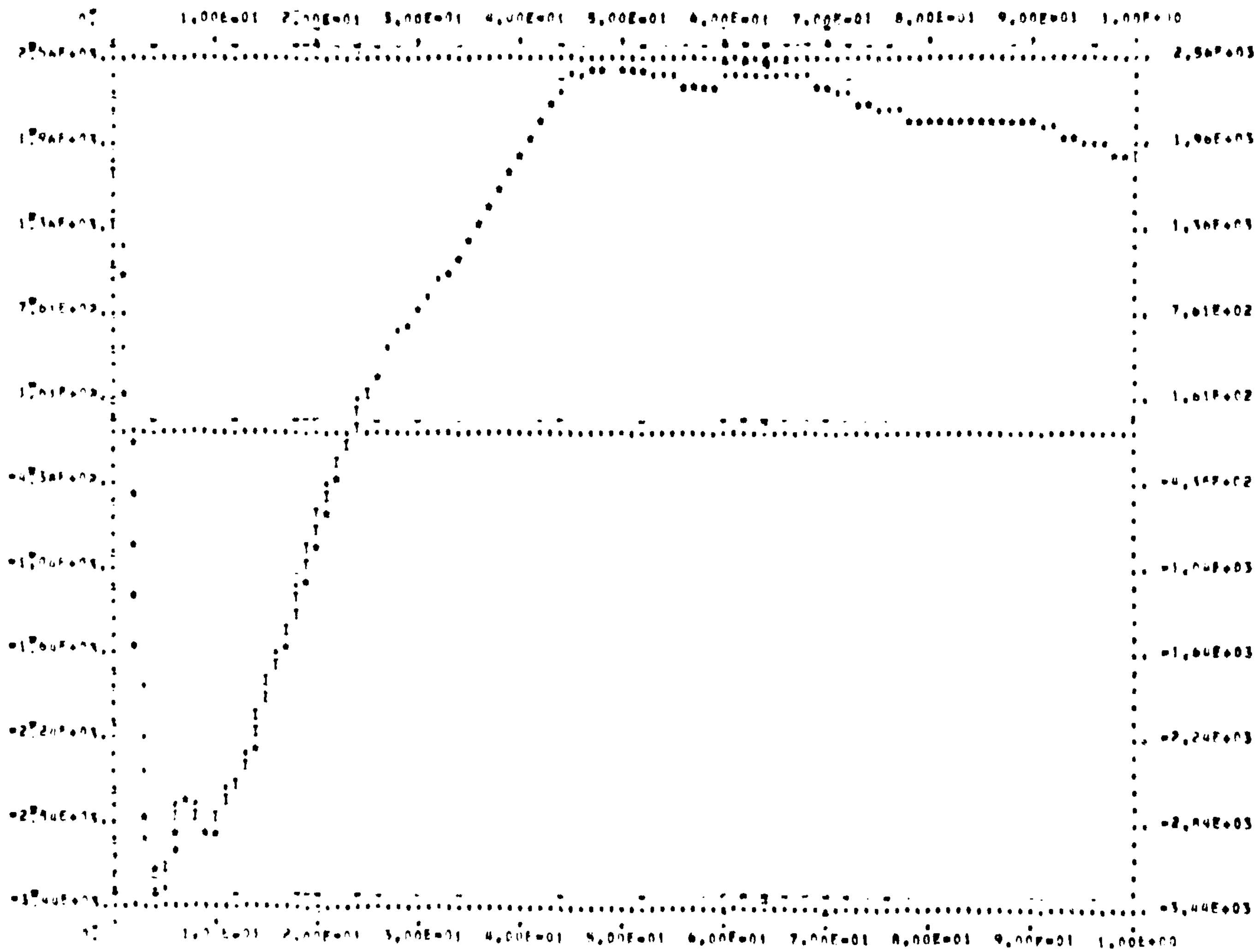




LOAD TIME HISTORY FOR RMS LOAD NO. 7 ORIENTATION NO. 4



LOAD TIME HISTORY FOR RMB LOAD NO. 8 ORIENTATION NO. 4



LOAD TIME HISTORY FOR RHB LOAD NO. ORIENTATION NO.

AD-A106 480 DOUGLAS AIRCRAFT CO LONG BEACH CA F/G 18/3
NUCLEAR BLAST RESPONSE COMPUTER PROGRAM. VOLUME I. PROGRAM DESC--ETC(U)
AUG 81 J A MCGREW, J P GIESING, T P KALMAN DNA001-75-C-0216
UNCLASSIFIED AFWL-TR-81-32-VOL-1 NL

5 OF 5
AD
A106480

END
DATE
FILMED
12 81
DTIC

DATE
TIME

MAXIMUM LOADS

STA	TIME	M STRESS	TIME	M STRESS	TIME	L STRESS	TIME	L STRESS	MAX	MIN
1	.0400	.11135E+06	.2240	-.11533E+06	.0400	.11019E+06	.2240	-.11533E+06	.98000E+06	-.98000E+06
2	.0820	.53245E+08	.1200	-.52609E+08	.0820	.52084E+08	.1200	-.52629E+08	.22000E+07	-.22000E+07
3	.2500	.65022E+05	.0160	-.55379E+05	.2500	.65028E+05	.0160	-.55379E+05	.10000E+07	-.11000E+07
4	.4700	.93453E+05	.1600	-.81376E+05	.4700	.93453E+05	.1600	-.81376E+05	.10000E+07	-.10000E+07
5	.2400	.54479E+05	.0980	-.52669E+05	.2400	.54479E+05	.0980	-.52669E+05	.80000E+05	-.80000E+05
6	1.0000	0.	0.0000	0.	1.0000	0.	0.0000	0.	.25000E+05	-.25000E+03
7	.4700	.96475E+08	.1980	-.10816E+06	.4700	.96475E+08	.1980	-.10816E+06	.20000E+06	-.20000E+06
8	.4900	.11384E+06	.1720	-.80182E+05	.4900	.11384E+06	.1720	-.80182E+05	.40000E+06	-.20000E+06
9	.4900	.25599E+04	.0440	-.34362E+04	.4900	.25599E+04	.0440	-.34362E+04	.10000E+07	-.10000E+07
10	1.0000	0.	0.0000	0.	1.0000	0.	0.0000	0.	.50000E+10	-.50000E+10

ORIENTATION NO. 6

MATERIAL VELOCITY= 19.880FPS
MAX ALLOWABLE VELOCITY= 60.5900FPS
P AMBIENT= 10.1727 PSI
OVERPRESSURE= .7268 PSI
MAX ALLOW. OVERPRESSURE= 1.1164 PSI

MAXIMUM POS. AND NEG. LOAD RATIOS

STA	LOAD	TIME
6	.5602	.4900
5	.6584	.0980

COORDINATES OF AIRCRAFT AND BURST AT TIME = -5.1280 SECS

AIRCRAFT (EFAS)
X = .48520E+04
Y = 0.
Z = .10200E+04

BURST (EFAS)
X = 0.
Y = 0.
Z = .81234E+04

DISTANCE BURST TO AIRCRAFT AT INTERCEPT
SLNTRI = .71234E+04 FT.

DISTANCE BURST TO AIRCRAFT NOW IS
SLNTRG = .84194E+04 FT.
XE-XR = .48520E+04 FT.
YE-YR = 0. FT.
ZE-ZR = -.71234E+04 FT.

DATE
TIME

```
RANGE ITERATION NO.   8

COORDINATES OF AIRCRAFT AND BURST AT TIME =     0.0000 SECS

 AIRCRAFT (FEAS)
X = -0.
Y =  0.
Z =   .10000E+04

BURST (FEAR)
X =  0.
Y =  0.
Z =   .8123AE+04

DISTANCE BURST TO AIRCRAFT AT INTERCEPT
SLNTR1 =   .7123AE+04 FT.

DISTANCE BURST TO AIRCRAFT NOW IS
SLNTRG =   .7123AE+04 FT.
XE-XA  =  0.          FT.
YE-YA  =  0.          FT.
ZE-ZA  =  -.7123AE+04 FT.

*******************

TAPE10 REWOUND

*******************

        TIME BACK TO BURST =    -5.1280 SECS
```

DATE
TIME

MAXIMUM LOADS

STA	TIME	R SIDE+	TIME	R SIDE-	TIME	L SIDE+	TIME	L SIDE-	MAX+	MAX-
1	.4300	.14727E+06	.2220	-.20363E+06	.4300	.14727E+06	.2220	-.20363E+06	.40000E+06	-.50000E+06
2	.4800	.80607E+08	.1880	-.94770E+08	.4800	.80607E+08	.1880	-.94770E+08	.22000E+09	-.20000E+09
3	.2900	.10440E+06	.0160	-.81634E+05	.2900	.10440E+06	.0160	-.81634E+05	.10000E+07	-.10000E+07
4	.4700	.13357E+06	.1580	-.14804E+06	.4700	.13357E+06	.1580	-.14804E+06	.10000E+07	-.10000E+07
5	.2400	.53107E+05	.0980	-.82161E+05	.2400	.53107E+05	.0980	-.82161E+05	.80000E+05	-.80000E+05
6	1.0000	0.	0.0000	0.	1.0000	0.	0.0000	0.	.25000E+05	-.25000E+05
7	.4700	.15476E+06	.1980	-.18370E+06	.4700	.15476E+06	.1980	-.18370E+06	.20000E+06	-.20000E+06
8	.4900	.14960E+06	.1700	-.15255E+06	.4900	.14960E+06	.1700	-.15255E+06	.20000E+06	-.20000E+06
9	.4900	.30039E+04	.0440	-.63109E+04	.4900	.30039E+04	.0440	-.63109E+04	.10000E+07	-.10000E+07
10	1.0000	0.	0.0000	0.	1.0000	0.	0.0000	0.	.50000E+10	-.50000E+10

ORIENTATION NO. 6

MATERIAL VELOCITY= 60.7779FPS
MAX ALLOWABLE VELOCITY= 59.1793FPS
P AMBIENT= 14.1727 PSI
OVERPRESSURE= 1.1200 PSI
MAX ALLOW. OVERPRESSURE= 1.0896 PSI

MAXIMUM POS. AND NEG. LOAD RATIOS

STA	LOAD	TIME
8	.7480	.4900
5	1.0270	.0980

COORDINATES OF AIRCRAFT AND BURST AT TIME = -5.2960 SECS

AIRCRAFT (FEAS)
X = .49644E+04
Y = 0.
Z = .10000E+04

BURST (FEAS)
X = 0.
Y = 0.
Z = .82600E+04

DISTANCE BURST TO AIRCRAFT AT INTERCEPT
SLNTGI = .72600E+04 FT.

DISTANCE BURST TO AIRCRAFT NOW IS
SLNTNG = .87050E+04 FT.
XE-XA = .49644E+04 FT.
YE-YA = 0. FT.
ZE-ZA = -.72600E+04 FT.

```
                                                            DATE
                                                            TIME

                  RANGE ITERATION NO.   1

                  COORDINATES OF AIRCRAFT AND BURST AT TIME =     0.0000 SECS

                   AIRCRAFT (EFAS)
                  X = -0.
                  Y =  0.
                  Z =   .10000E+04

                  BURST (EFAS)
                  X =  0.
                  Y =  0.
                  Z =   .82600E+04

                  DISTANCE BURST TO AIRCRAFT AT INTERCEPT
                  BLNTRQ =    .72600E+04 FT.

                  DISTANCE BURST TO AIRCRAFT NOW IS
                  BLNTRG =    .72600E+04 FT.
                  XE-XB  =  0.             FT.
                  YE-YB  =  0.             FT.
                  ZE-ZB  =  -.72600E+04 FT.
******************

TAPE90 REWOUND

******************
                  TIME BACK TO BURST =    -5.2460 SECS
```

DATE
TIME

MAXIMUM LOADS

STA	TIME	R SIDE+	TIME	R SIDE-	TIME	L SIDE+	TIME	L SIDE-	MAX+	MAX-
1	.4300	.14455E+06	.2220	-.19766E+06	.4300	.14455E+06	.2220	-.19766E+06	.50000E+06	-.50000E+06
2	.4800	.79113E+08	.1880	-.91910E+08	.4800	.79113E+08	.1880	-.91910E+08	.22000E+09	-.22000E+09
3	.2500	.10171E+06	.0160	-.79827E+05	.2500	.10171E+06	.0160	-.79827E+05	.10000E+07	-.10000E+07
4	.4700	.13110E+06	.1600	-.14350E+06	.4700	.13110E+06	.1600	-.14350E+06	.10000E+07	-.10000E+07
5	.2400	.51811E+05	.0980	-.80130E+05	.2400	.51811E+05	.0980	-.80130E+05	.80000E+05	-.90000E+05
6	1.0000	0.	0.0000	0.	1.0000	0.	0.0000	0.	.25000E+05	-.25000E+05
7	.4700	.13201E+06	.1980	-.17855E+06	.4700	.13201E+06	.1980	-.17855E+06	.20000E+06	-.20000E+06
8	.4900	.14700E+06	.1700	-.14764E+06	.4900	.14700E+06	.1700	-.14764E+06	.20000E+06	-.20000E+06
9	.4900	.30535E+04	.0440	-.61133E+04	.4900	.30535E+04	.0440	-.61133E+04	.10000E+07	-.10000E+07
10	1.0000	0.	0.0000	0.	1.0000	0.	0.0000	0.	.50000E+10	-.50000E+10

ORIENTATION NO. 6

MATERIAL VELOCITY= 50.3650FPS
MAX ALLOWABLE VELOCITY= 59.2689FPS
P AMBIENT= 14.1727 PSI
OVERPRESSURE= 1.0931 PSI
MAX ALLOW. OVERPRESSURE= 1.0913 PSI

MAXIMUM POS. AND NEG. LOAD RATIOS

STA	LOAD	TIME
8	.7356	.4900
5	1.0016	.0980

COORDINATES OF AIRCRAFT AND BURST AT TIME = -5.2384 SECS

AIRCRAFT (FFAB)
X = .49571E+04
Y = 0.
Z = .11000E+04

BURST (FFAB)
X = 0.
Y = 0.
Z = .82520E+04

DISTANCE BURST TO AIRCRAFT AT INTERCEPT
SLNTRO = .72520E+04 FT.

DISTANCE BURST TO AIRCRAFT NOW IS
SLNTRG = .87845E+04 FT.
XE-XA = .49573E+04 FT.
YE-YA = 0. FT.
ZE-ZA = -.72520E+04 FT.

CONVERGED SOLUTION
3 ITERATIONS
CRITICAL RANGE IS 7252.02FT.

DATE
TIME

INTEGRATED LOAD DEFINITIONS

LOAD	BEAM	NODE	COMP	XAAS	YAAS	ZAAS
1	8.0	4.0	1.0	.89000E+03	.12000E+03	0.
2	4.0	1.0	1.0	[illegible]	.12000E+03	0.
3	6.0	6.0	8.0	[illegible]	0.	0.
4	6.0	6.0	9.0	[illegible]	0.	0.
5	10.0	4.0	1.0	[illegible]	.93000E+02	.11310E+03
6	10.0	2.0	3.0	.16372E+04	0.	.12000E+03
7	1.0	4.0	1.0	.10111E+04	.37500E+03	.44960E+02
8	2.0	4.0	1.0	.10111E+04	.37500E+03	.44960E+02
9	3.0	4.0	4.0	.89000E+03	.37500E+03	-.55000E+02
10	8.0	4.0	2.0	.89000E+03	0.	0.

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